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View of Completed Highway

Some Details of the CUBAN CENTRAL HIGHWAY

By FRED S. WILSON

Testing Engineer, Consolacion del Sur, Pinar del Rio, Cuba

CUBA as a republic is very young. Certainly no such ambitious construction program as the Cuban Central Highway would have been considered seriously in the United States during President Monroe's "Era of good feeling," yet General Machado is only Cuba's fifth president. His predecessors were kept busy ironing out the ever present problems of a new government—school systems, agricultural programs, army and navy affairs, political strife and the readjustments necessary after the war with Spain and the subsequent American intervention. The time devoted to the above mentioned problems, and many unmentioned, left little chance for consideration of Cuba's one pressing need, namely, a suitable arterial highway extending from one end of the island to the other. True, there were patches of improved roads, of the water bound macadam type, the mere semblance of a central highway from Santiago de Cuba to Havana and thence to Pinar del Rio, but this highway had become almost

impassable through mis-use and lack of maintenance.

High Railway Rates Hastened Building of Highway.

—One important factor that hastened the building of the Central Highway was the freight and passenger rates charged by the existing railroads. For example, eight months ago the cost of a round trip ticket between Consolacion del Sur and Havana (150 kilometers) by train was \$10.00. Today the same trip can be made by bus over the Central highway for \$2.55. The need for better roads was felt so keenly by everyone that the present administration could no longer ignore it and they have devoted almost their entire energy to the one purpose of giving Cuba this thoroughfare.

The contract for the construction of the Central Highway was let in two portions, the larger part going to the Warren Bros. Co., Boston, Mass., while the remaining was awarded to the Cuban Contracting Co. On that portion of the highway being built by the Warren Bros. Co., Warrenite-Bitulithic pavement is used.

The Cuban Contracting Co. is using an asphaltic concrete topeka mixture. The limits of the highway are Pinar del Rio at the west end of the island and Santiago de Cuba on the east. The highway is very centrally located and passes through the more important cities and towns in the central portion of the island.

The Route.—Starting at Pinar del Rio, the road passes through a country called Vuelta Abajo where the best of the world famous Cuban cigar tobacco is grown. Next is a district famous for its winter vegetables, most of which are shipped to the States. Then comes a small sugar cane district just west of Havana. Paralleling the highway about five kilometers to the north between Pinar del Rio and Havana is a beautiful and colorful mountain range. Beyond Havana are the provinces of Matanzas and Santa Clara where can be seen miles and miles of sugar cane plantations with some rather extensive plantings of henequin in parts of Matanzas. The sugar plantations extend on into Camaguey province but in the eastern end of Camaguey and the western part of Oriente are extensive cattle ranches. Another sugar cane district is encountered in



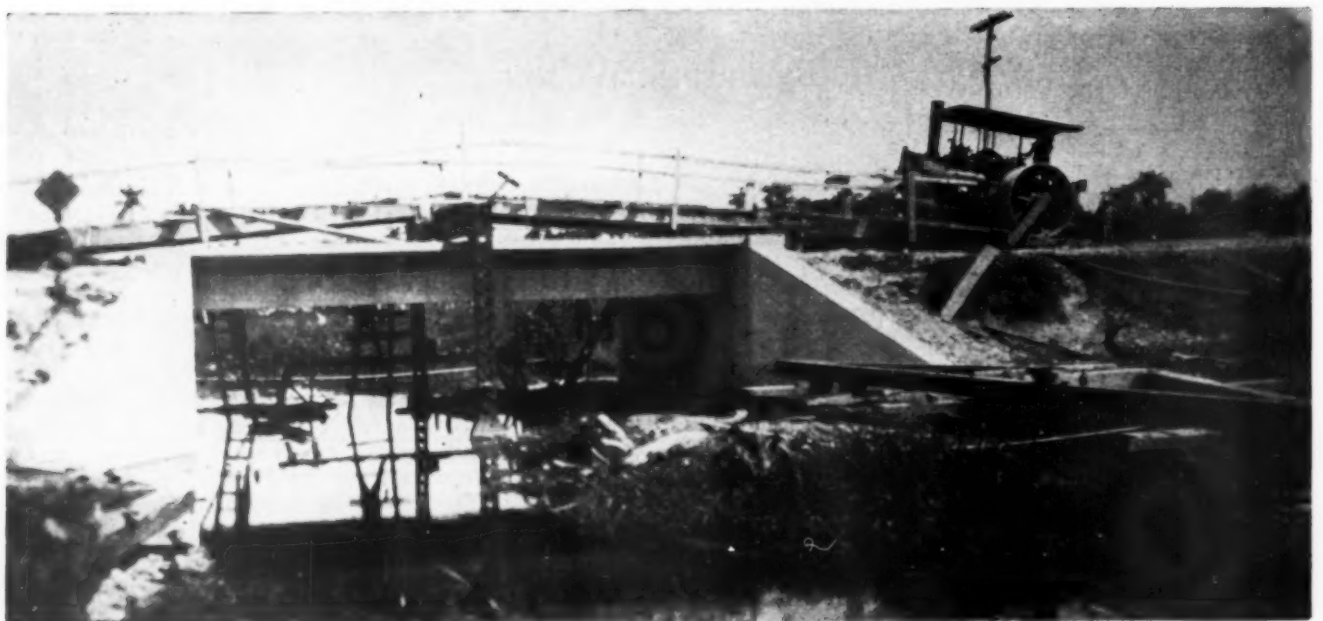
View of Old Highway



Part of the Central Highway Before Paving



Overhead Railroad Crossing During Construction



Temporary Crossing Over New Concrete Bridge



Concrete Bridge Known Locally as the "Bull-Cart-Wheel" Bridge



Left—Section of Completed Highway. Note Barbed-Wire Right-of-Way Fence; Also Farm-Entrance Culvert.
Right—Granite-Block Crossing for Ox Carts



the central portion of Oriente Province, but as Santiago de Cuba is neared the country becomes very mountainous and here are found large mining interests and much hard wood lumbering.

The island is divided into six provinces named in order from west to east: Pinar del Rio, Havana, Matanzas, Santa Clara, Camaguey, and Oriente. The road project itself is divided into 32 sections each approximately 33 kilometers in length. Section No. 1 starts at Pinar del Rio and Section No. 32 ends at Santiago de Cuba. The highway through Santa Clara and Matanzas is being paved with asphaltic concrete while the remainder is paved with Warrenite-Bitulithic.

All the rivers of Cuba are necessarily short due to the narrowness of the island, but these rivers turn into torrential floods after each heavy rain and so the design of bridges for this highway presented some interesting problems. Heavy rains occur almost daily during the rainy season which lasts about four months each year. This heavy and sudden rainfall demanded that special attention be paid to drainage problems and this factor alone increased the cost of the highway considerably. Cuban engineers have learned that good roads require good drainage. Concrete was used wherever possible in bridge construction as a matter of economy since all steel was of necessity imported.

Guard Rail and Roadside Beautification.—At all places where the grade is two meters high or more a guard rail has been placed. This is constructed with concrete posts, 1:2:3 mixture, and strung with two $\frac{3}{4}$ in. steel wire cables.

Growing on either side of the old highway were enormous trees whose foliage made an arched verdure for miles. The distance between these two rows of trees was too narrow to accommodate the new highway and for this reason, as well as the fear of possible damage to the new pavement by the root systems of these old veterans, they were all destroyed. They are, however, being replaced by new saplings planted thirty feet apart on both sides of the pavement. These trees are of a fast growing variety and will soon enhance the beauty of the new road appreciably. In order to permit traffic unobstructed vision throughout, planting of these trees was omitted on the inner side of all curves.

Storm Water Carried Under Sidewalk.—In all towns and cities through which the highway passes, the curb and gutter is included in the paving project. Surface drainage in these towns is handled in an unusual manner. The sidewalk is virtually a box culvert, the top of the box being the sidewalk. Numerous openings made in the curb lead into the box which of course drains into some suitable outlet at the edge of the town.

Right of way limits are defined on either side from one end of the project to the other by 5-strand barbed wire fences nailed to native hardwood posts.

Road Material Supplies.—In some parts of the island the search for suitable road building materials was discouraging. There was a particular shortage of concrete sand fit for first class concrete. Very often it was difficult to find a reliable supply of sand for even the second class concrete used in the concrete base. There was an abundance of good asphalt sand in most localities. There are mountains of stone in most parts of the island, but there is only one permanently located, Cuban owned, quarry and crusher from which suitable material in needed quantities could be purchased. This is the Camea Quarry Co., near Havana. In all other localities the contractors were forced to install quarrying and crushing outfits to produce their own materials. It is a provision of the contract that all portland cement be bought from the El Moro Cement Co., a Cuban industry located at the port of Mariel in Havana Province. This company is a part of the vast International Cement System and is manufacturing a first class cement in every respect.

Special Features of Work.—A great number of features in this project strike one as being unusual. It is provided in the contract that at all times more than 70 per cent of all labor on the payrolls must be Cuban. The government also reserves the right to fix the hourly rate of pay for the common labor, within certain limits. This rate has varied from 16 to 20 cents an hour. The prevailing rate at this time is 16 ct. Completed work is accepted only in units of 5 kilometers each. All work is guaranteed against faulty workmanship for a period of five years and the asphalt surface carries an unconditional guarantee and maintenance for six years.

Special Pavement Crossings for Ox Carts.—Although the highway crosses railroad lines at a number of places, all grade crossings have been eliminated by overheads or underpasses. The highway has been purposely diverted around the outskirts of Camaguey, third largest city in Cuba, in order to speed up through traffic. There have been many kilometers of auxiliary road built paralleling the highway for the use of ox carts used for 90 per cent of the heavy hauling in rural dis-

tricts. These carts are forbidden the use of the Central highway inasmuch as their steel tires would soon damage the asphalt surface. At places where it is imperative that ox carts cross the highway, a granite block crossing has been inserted for their convenience.

Maintenance engineers on the highway have had a law passed forbidding the use of an automobile jack on the asphalt pavement. This may be carrying it a bit too far, but it shows clearly that they want to treat the new pavement kindly. This law is enforced, too, and is punishable by a five dollar fine for the first offense. All steel bridges are floored with granite block, grouted in with cement filler.

The header curb on both sides of the pavement is painted white to increase visibility at night.

Economic Results of Highway.—Some of the ultimate benefits of the highway are already in evidence although the project is not quite finished. Everywhere there are buses that offer cheap, safe, and rapid transportation to and from Havana, the Mecca of all Cubans. Many transportation companies have already come into being. They are hauling supplies to the inland towns at substantial saving in freight charges. This saving is reflected in the price of foodstuffs to the ultimate consumer. Farmers are finding a ready market for their products in Havana and other centers of population now that they can get these products into the markets in first class condition. The small towns are becoming more pleasant places to live in each day. When completed this highway will be an additional attraction to American tourists who now are allowed to use their private cars in the island for a period of 90 days free from any tax or license fee.

Cuba has had this taste of good roads in her Central highway, and now all the towns on either side of the highway are asking for secondary or feeder roads so that they may receive equal benefit from the main road. According to the best authorities these secondary roads are to be built as soon as sufficient funds can be raised. Just at this time Cuba is struggling under the load of a depression that is world wide and is perhaps justified in feeling discouraged, but fortunately her leaders realize that a dollar spent for building good roads is a dollar very well spent.



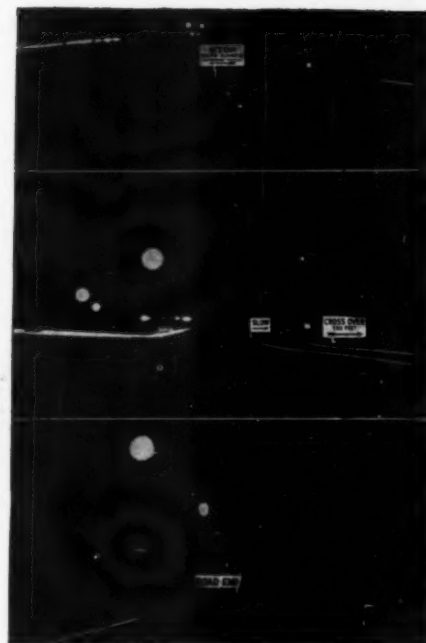
Concrete Bridge Near Santiago de Cuba



Traffic-control lights at paved intersections save time, lives. Flashing signals and floodlighted signs guard three-way intersections and road ends. Detour signs floodlighted where possible. Change in system of striping pavements. Blind intersections eliminated

Floodlighted Signs Aid the Traffic at Night

Reflectorized Signs Are Placed on the Entire County Road System for Added Safety



Highway Safety System of Wayne County

SAFETY engineering as practiced by the county road commission of Wayne County, Mich., starts from the very conception of a new road, or a new bridge and forms a basic part in the general maintenance scheme. The sound principles of engineering and design which must necessarily be built into each new project include many things which go toward making the paved roads better and safer for the use of the public. In addition the commission has developed a very elaborate system of traffic-control signals, warning signals and warning signs. An interesting summary of these safety measures are given in the 24th annual report of the commission.

Traffic Control Signals.—One of the most important items in the highway safety system is the control of traffic at two paved intersections. In Wayne County the longest possible delay at any intersection due to a red light is 40 seconds and the average delay when one arrives just as the signal turns red is 30 seconds. Considering the law of averages, one can travel the length of the longest road in Wayne County, or about 30 miles, and be delayed on account of traffic signals but a little over 3 minutes.

In traveling this 30 miles he has some 13 paved intersections to cross and if they were not protected with signals it would mean that on 13 occasions speeding motorists would be crossing his path, each individual motorist judging as to who had the right-of-way.

Warning Signals.—At all three-way intersections and at all road ends, amber flashing warning signals have been installed. In the cases of road ends, a large sign is placed at the end of the road and floodlighted from the signal. Such floodlighted signs can be seen for a great distance at night and greatly aid the night traveler.

Where construction or repair work is being done on a road which has been left open for travel, great care is always taken to mark such locations with red lanterns and bombs, so that at night motorists can plainly see, far in advance, that a hazardous condition exists.

When it becomes necessary to detour traffic, adequate

signs are placed, and when electricity is available those signs are floodlighted. In 1929 there were four such locations floodlighted; this year there are over fifty.

Warning Signs.—There are hundreds of directional and warning signs placed on the roads. In cases where, due to some extraordinary condition, it is wished to emphasize the signs so that the motorist will not fail to see them, reflector buttons have been placed in the sign. The lights of an automobile will be reflected by these buttons and the sign will be made to show up in such a way so that it can be read at a considerable distance.

Pavement Striping.—The method of striping the pavement has been slightly changed this year on all pavements over 20 ft. wide. Previously one white stripe was put down the middle of the pavement, thus dividing it into two equal parts. This year lanes have been striped off approximately 10 ft. wide. This has its advantage over the single strip in that it allows a number of cars to pass or meet one another with greater safety, for each one has a definite lane in which to travel.

At curves and where a hill is encountered, a yellow stripe has been substituted for the customary white one. This has been changed to indicate the importance of strictly observing the striping where at curves a motorist cannot see an approaching car very far in advance or on hills where one should not attempt to pass around another car before a view over the top of the hill can be obtained.

Removal of Blind Intersection.—Intersecting roads are periodically inspected so as to avoid the possibility of blind intersections. Trees are trimmed, brush is cut and in some instances earth moved so that cars approaching the intersection can be seen by one another. This is most important where gravel or dirt roads meet with a paved road, because where two paved roads intersect the crossing is guarded with a traffic signal, while in all other locations the safe manner in which traffic crosses depends entirely on the clear and unobstructed view of the motorists.

New Pavements, Bridges, Improve

Pictures from A. MACARTHUR

Assistant Engineer Road Construction, Indiana State Highway Department, Indianapolis, Ind.

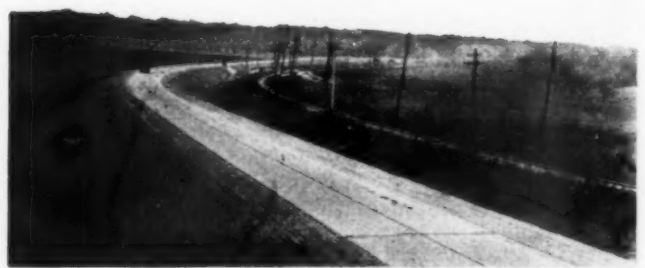


Work on State Road 6 in Lake and Porter counties: Left—Removing 8 Ft. of Muck; Above—Backfilling with Sand; Below—Sand Backfill in Place



Left — Dynamiting Mud on State Road 6 in Noble County

*(Next Month:
Construction
Pictures
from
California)*



On U. S. Route 24 in Huntington County, Between Lagro and Huntington; Left—During Grading; Right—View of Completed Pavement

Indiana Highways



Between Wabash and Lagro in Wabash County, on U. S. Route 24; Left—During Construction; Above—After Completion



Monon Overhead Crossing Between Bedford and Bloomington, in Monroe County



Above—Grading for Bridge Over Lost River; 33,000 Cu. Yd. in This Fill

Below—U. S. Route 24 in Wabash County





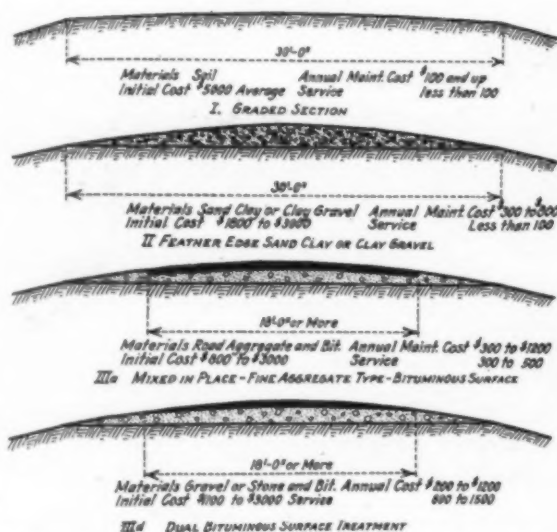
A Well-Graded and Well-Drained Mexico Road Without Surfacing. Note Wide Section

Road Building and Maintenance in the Southwest

By C. N. CONNER
Associate Editor

THE southwestern states present problems in construction and maintenance which are little realized by road builders in the wealthy states of the Mississippi valley and the east. This section of the country represents a tremendous area, it contains a small population per unit of area and there is needed a large mileage of serviceable roads at low cost.

The accompanying tabulations clearly show these conditions and how the state programs are following the methods of stage or progressive construction. This method of stage construction is illustrated on the accompanying cross-sections as a typical example of how a graded road may be improved from a traffic capacity of 100 vehicles per day to 1,500 vehicles per day, and at a low cost.



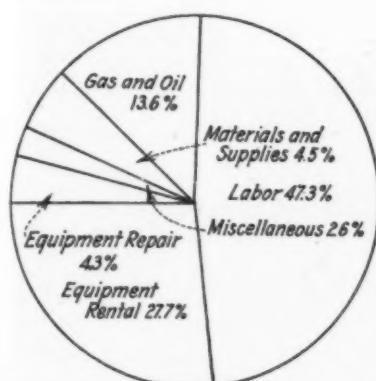
Illustrating Practical Application of Stage Construction. From Report on Investigation of Low-Cost Improved Roads, Courtesy of Highway Research Board

The problems in these states are similar to those in many counties, but their administration, organization, construction and maintenance methods can be profitably studied by those who must build and maintain large mileages of highways with small appropriations.

A knowledge of the cost of maintaining various types of surfacing is necessary intelligently to plan a program. Especially is this true in states such as Arizona, which makes extensive use of local materials. By carefully recording these costs as shown on the accompanying graphs, this state is able to budget its funds intelligently and improve the traffic capacity of these surfaces of local sand-clay, caliche and gravel by oil processing and other low-cost methods.

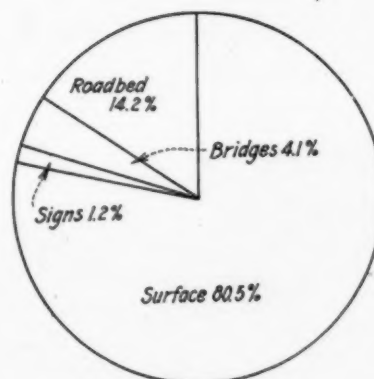


Left—Nearing Monterey on Laredo-Monterey Road. Road Is Surfaced with Local Gravel. Note Crown. Right—Mexico-Puebla Road. This Road Was Surfaced with Local Volcanic Gravel and Treated with Asphaltic Oil

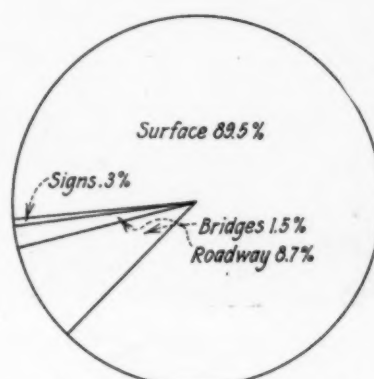
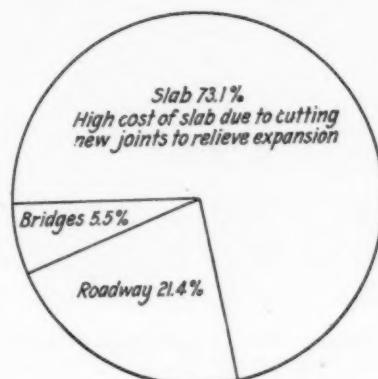
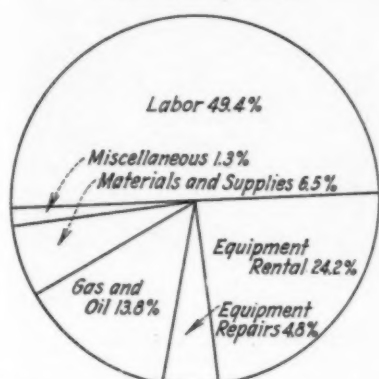


Maintenance Dollar for Fiscal Year 1927-28; Total Expenditure, \$669,020.72; Division by Items of Expense

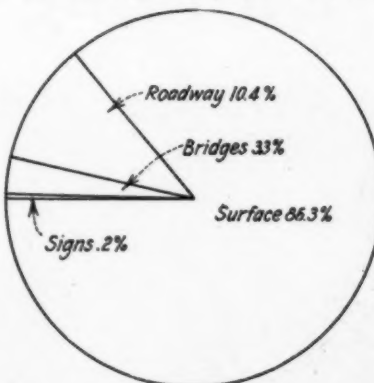
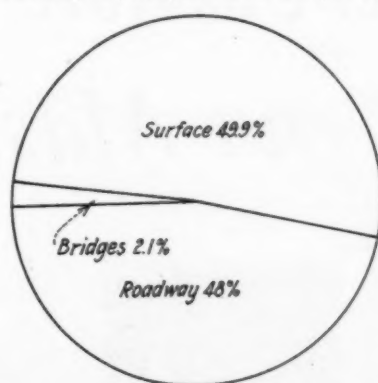
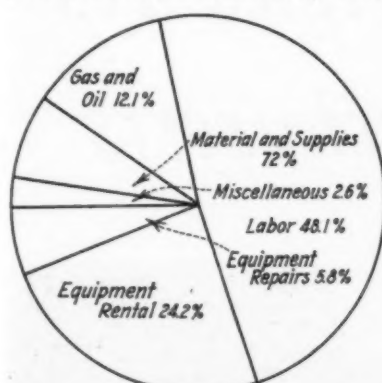
Charts Showing Division of the Arizona Maintenance Dollar Among Items of Expense and Among Roadway Upkeep Units, for Paved and Unpaved Surfaces



Division of 1927-28 Maintenance Dollar by Units of Roadway Upkeep—Unpaved Surfaces



Maintenance Dollar for Fiscal Year 1928-29; Total Expenditure, \$996,416.06. Left—Division by Items of Expense; Center—Division by Units of Roadway Upkeep, Paved Surfaces; Right—Division for Unpaved Surfaces



Maintenance Dollar for Fiscal Year 1929-30; Total Expenditure, \$1,192,609.30. Left—Division by Items of Expense; Center—Division by Units of Roadway Upkeep, Paved Surfaces; Right—Division for Unpaved Surfaces

TABLE I—AREA, POPULATION AND MOTOR VEHICLES IN SOUTHWESTERN STATES

State	Area in Sq. Miles	Population	Population per Sq. Mile	1929 Vehicle Registration	Persons per Vehicle
Arizona	113,956	474,000	4.16	109,013	4.35
Nevada	110,690	77,407	0.7	31,915	2.43
N. Mex.	122,634	415,000	3.4	78,374	5.29
Utah	84,990	531,000	6.3	112,661	4.71

TABLE II—MILEAGE OF EXISTING TYPES OF HIGHWAYS AT END OF 1929

State	Graded and Drained	Low-Cost Types	Bituminous Macadam	Bituminous Concrete	Cement Concrete	Other Types
Arizona	334	1,463	23	44	145	256
Nevada	240	1,079	21	2	51	338
New Mexico	3,215	2,100	—	—	85	—
Utah	1,194	1,305	5	53	220	671

TABLE III—1930 CONSTRUCTION PROGRAMS, MILEAGE BY TYPES

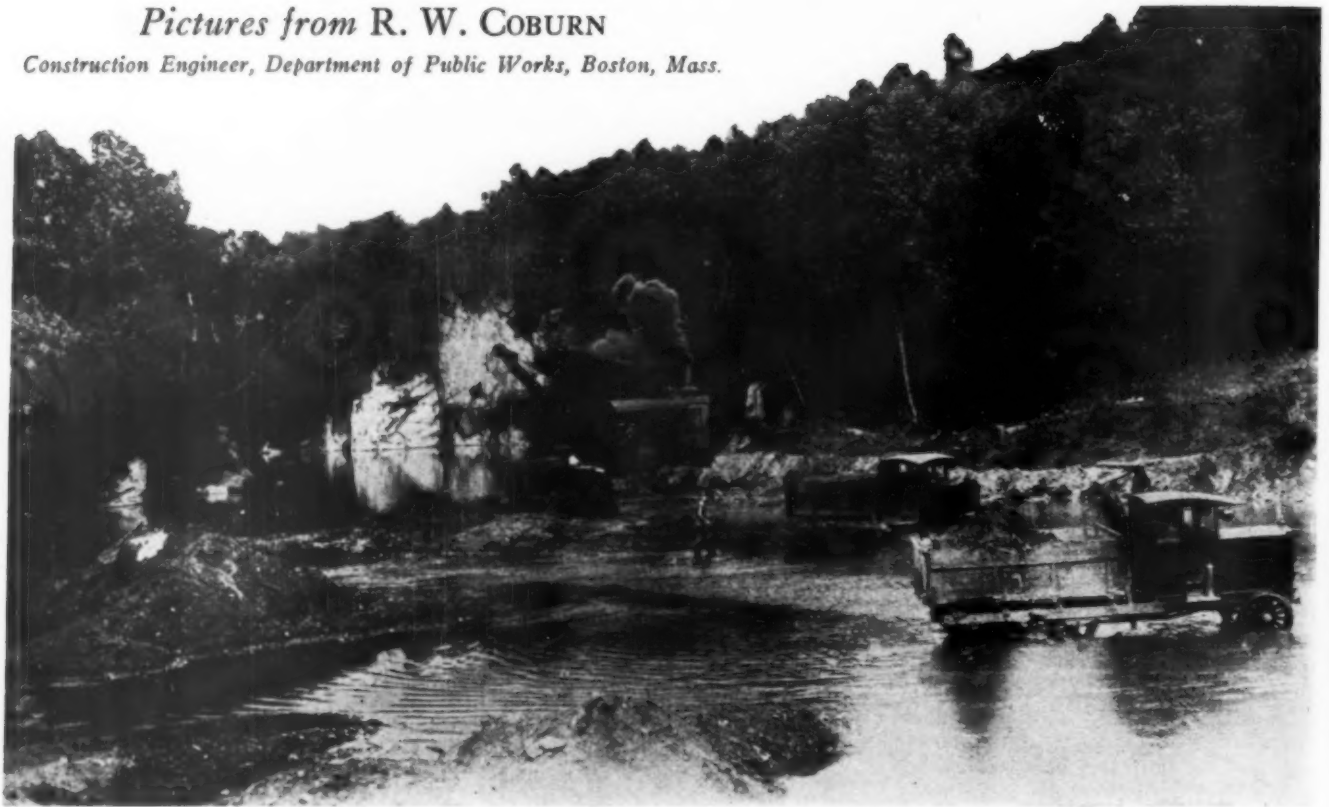
State	Earth Improved	Low-Cost and Intermediate	High Type
Arizona	123	325	10
Nevada	80	401	—
New Mexico	950	225	—
Utah	—	270	—

TABLE IV—PROPOSED 1930 EXPENDITURES

State	Construction	Maintenance	Annual Average on Equipment
Arizona	\$3,561,000	\$2,140,000	\$135,000
Nevada	1,820,000	600,000	75,000
New Mexico	4,150,000	3,125,000	500,000
Utah	2,700,000	1,000,000	100,000

Pictures from R. W. COBURN

Construction Engineer, Department of Public Works, Boston, Mass.



Relocation of River Channel, North Adams, Mass.; Lane Construction Corp., Meriden, Conn., Contractors

Building Serviceable Highways in Massachusetts



Bituminous Macadam Construction, Town of Florida, Mass., on Mohawk Trail; D'Onfro Bros., Contractors. Left—During Construction; Right After Completion



View at North Adams, Mass., Before Reinforced - Concrete Construction Was Begun by Lane Construction Corp. Picture Below Taken After Completion

Striking improvements in roads of the Massachusetts state highway system are depicted in the illustrations on this and the preceding page.



Reinforced-Concrete Construction at North Adams, Mass.; Lane Construction Corp., Meriden, Conn., Contractors. Compare with Illustration Above

Bulldozer and Rooter
Operations on Wil-
liams-Ukiah Highway



Power-Shovel Work
near Blairsden



Mountain Road GRADING *with 7-yd. Scrapers*

*Scraper-grading proves economical on
two mountain contracts. A novel water-
supply systems for grade wetting*

EXTRA large scrapers with rooters and bulldozers were used by two California contractors during the present season with excellent results in grading on mountain road jobs. There are two essentials for this method: (1) material which can't be loosened with a rooter sufficiently to be picked up by a scraper, and (2) hauls short enough for economical scraper transportation.

The Williams-Ukiah Highway Job.—This work is in Calusa County, Calif. The contract begins 5 miles west of Williams and for 4 miles crosses the level Sacramento valley, then follows the dry and rocky canyon of Salt Creek for 6 miles to the head of this water course, continuing 2 miles beyond the divide to Bear Creek. The ground is quite rocky in places, stones 2 to 3 ft. across being encountered. The contract amounted to \$140,000 and included 240,000 cu. yd. of excavation at 35 ct. per cu. yd. The contractor, Robert Le Tourneau, of Stockton, Calif., will use two 7-yd. Le Tourneau scrapers on the job. Before scraping, the ground was loosened with a Le Tourneau rooter, which was drawn by a 60-hp. Caterpillar tractor, to which was attached a Le Tourneau bulldozer. Both were operated with a Le Tourneau improved power take-off by the Caterpillar skinner.

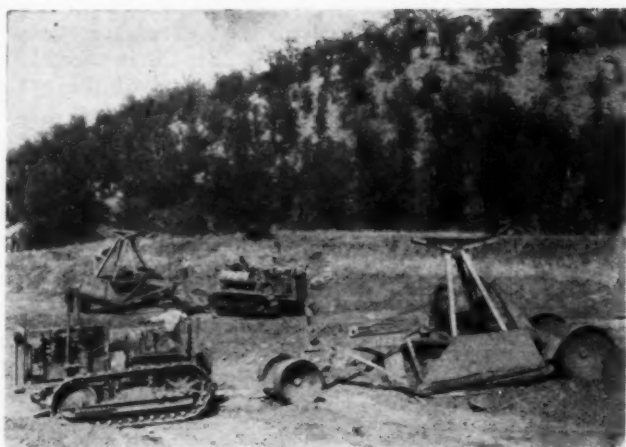
Noting Le Tourneau's success in scraper-grading, Charles Harlowe decided to use the same equipment for executing an 8-mile contract in the Sierra Nevada Mountains near Blairsden, on the headwaters of the Feather River. The excavation totaled 212,000 cu. yd. and the contract price was \$118,000.

The Blairsden Job.—Most of the digging was good, being sandy, yellow clay, and the progress made was quite satisfactory. In places there was shale and stony formation hard enough to require the services of a power shovel. A 1¼-yd. gas-air Bucyrus-Erie excavator and two new International 4-yd., 6-wheel Heil-hoist motor trucks took care of these sections most effectively.

Two new 60-hp. Caterpillar tractors equipped with Le Tourneau power take-offs were purchased to pull the scrapers. Another power unit of the same kind pushed the bulldozer and pulled the rooter, both being operated by the Caterpillar driver.

The scrapers are dumped by pulling forward a gate in the back of the bowl, expelling the load in front as the machine moves forward and spreading material any desired depth. The front wheels roll under the tongue, making a short turning radius.

General Features of the Road.—The Blairsden road



Two 7-Yd. Scrapers on Williams-Ukiah Job

is being built under the supervision of the U. S. Bureau of Forestry. The grade is 22 ft. wide in fills, which allows for a 3-ft. shoulder on each side of the 16-ft. portion to be hard-surfaced. This strip is widened to 5 ft. and 6.5 ft. on the inside of curves.

The cuts are 28 ft. wide at the bottom, which gives room for a 3-ft. ditch and shoulder of equal width on each side of the 16-ft. pavement space. Like most of the newer California roads, there are no short curves on this section, most of the turns having a radius of 500 to 3,500 ft. A few are 300 to 350 ft., the sharpest being 225 ft.

It was difficult to use wheel machines on the steep slopes over which the survey passes; therefore the bulldozer was employed to level a track for the scrapers. Work was commenced on the extreme upper side of a cut, instead of in the middle, and a notch dug in the hillside. The blade being adjustable, the upper end was tipped down, thus increasing the resistance to that side of the tractor.

Construction Features.—It was found best to start fills by dumping dirt at the extreme lower edge, because this provided a level track for the scrapers and finished the grade as it was built up. Instead of depositing material in piles, it proved more desirable to spread layers from the very beginning.



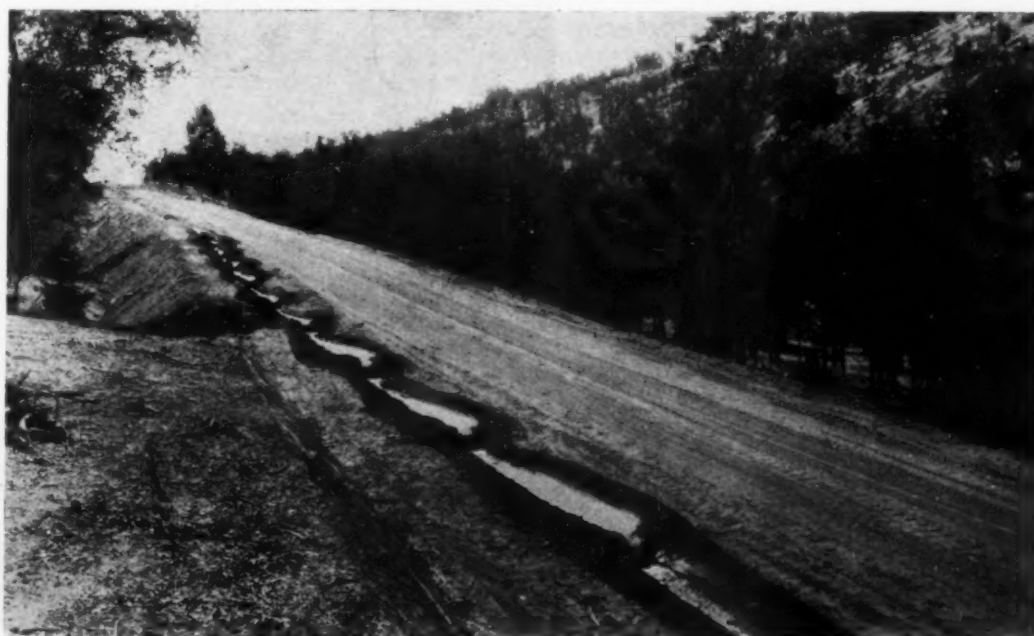
Scraper-Grading near Blairsden

When mounds are made in unloading, their uneven outer edges must be smoothed off afterwards with a bulldozer or other implement. The sloping sides of such piles render it difficult to run the scrapers close enough to the edge of the grade to dump additional loads there. When, however, dirt is spread in level layers as it is forced off the scraper, a little is pushed out beyond the end of the blade, which can be run near enough the edge of the fill to build up the grade clear out to the stakes.

The rooter was found to work best by running two standards deep in the ground, instead of three near the surface, because the former method requires less power in proportion to the amount of earth loosened. The points also are kept sharper in deep rooting, in which they wear mostly on the under side, instead of the upper, as in shallow scarifying. On the second round, one of the standards split the ridge left between the two V-shaped trenches previously broken up.

The Caterpillar graders used on both jobs has a side-wing attachment to the blade which proved very useful for sloping cut banks.

Water System for Grade Wetting.—On the Williams job a unique water system was devised for grade wetting. The water was run 6 miles through an open ditch. The water was drawn from Bear Creek, the



Water System for Grade Wetting Devised on Williams Job

only available source of supply, by a Domestic Giant 100-g.p.m. plunger-type pump powered with a 35-hp. Continental gas engine. It was forced against 300 lb. pressure to a height of 400 ft. through 10,000 ft. of 3-in. iron pipe. Water was first run down the dry bed of Salt Creek, which closely follows the survey of the new road. This method proved impracticable, on account of excessive losses from evaporation and seepage.

The Caterpillar grader was then used to open a small ditch at one side of the road grade, this ditch being extended as the grade was lengthened. Erosion was negligible where the grade was less than 4 per cent. Down grades of 4 to 6 per cent, a series of checks or baffles was put in. These consisted of earth dams 1 ft. high, quickly thrown up with a hand shovel.

Water was carried over the barriers through short

sections of old iron pipe or over chunks of wood. Short pieces of small logs were cut from trees removed in clearing the right-of-way and a notch made in one side to receive the stream. Near the lower end of the grade section then being built a small dam was thrown across the ravine with the bulldozer. As the grade was extended, additional barriers were quickly constructed in suitable locations.

Water was lifted from the dam with a 100-g.p.m. single-cylinder, double-action piston pump powered with a Durant 6 automobile engine. The water was forced through 1,000 ft. of 2½-in. fire hose, to which 1-in. lines were attached for wetting down the grade. Surplus water escaped through a faucet and was by-passed through a spillway to the stream bed below, which conveys water to the next reservoir. Only 10 per cent of the water was lost by this method.

The New \$300,000 Maumee River Bridge

OHIO'S newest and one of its most beautiful bridges was recently dedicated at Napoleon, Ohio. This is a 750-ft. \$300,000 concrete bridge over the Maumee River.

Located between Toledo and Fort Wayne on U. S. Highway 24, which runs from Detroit to Kansas City, the new bridge also serves Ohio state highways 33 and 34. It is a reinforced-concrete arch bridge with seven 95-ft. clear spans, a 36-ft. roadway and two 5-ft. sidewalks. Railings and balusters are of precast concrete. Piers and abutments went 2½ ft. into rock. The project involved 18,000 cu. yd. of excavation. Materials included 460,000 lb. of structural steel, 67,000 sacks of Universal cement and 314 carloads of granulated slag to fill the spandrels.

The concrete for footings and piers was placed by cold-weather methods—amid 14-below-zero temperatures. Passing aviators will find "Napoleon" spelled with brick in the bridge pavement.

One of the requirements was the moving of a 50-year-old, three-span, wooden-floored narrow bridge to one side to keep it serving traffic during the 19-month construction period, which ended on May 7, nearly five months earlier than the date specified. One span at a time was pulled 150 ft. downstream, sidewise, by means of a four-way block, on its pair of trestle-supported greased steel rails, to temporary piers built

of piles and filled rip-rap. Two of the three spans were later moved still farther downstream to connect Indianola Island, near Toledo, with the shore.

The bridge was designed by D. H. Overman under the supervision of J. R. Burkey, chief engineer, and W. H. Rabe, chief designing engineer, of the bureau of bridges of the state highway department. Richard Orth, construction engineer, was assisted by Harry R. Wagner and by John F. Gallier, division engineer at Toledo, and C. F. Kelley, resident engineer at Napoleon. The Miller-Taylor Construction Co., Waterloo, Ia., was the contractor.

Right—Fifty-Year-Old Bridge, Moved Downstream to Temporary Site, Continues to Serve Traffic While New \$300,000 Structure Takes Shape

Below—Side View of New Maumee River Bridge



What an Adequate Traffic Signal System Must Do

By J. ROWLAND BIBBINS

Consulting Engineer, Washington, D. C.

AT the recent 18th annual Safety Congress and Exposition held Sept. 29-Oct. 3 at Pittsburgh, Pa., a particularly comprehensive list of papers was presented before the Traffic Section of the Congress. One of the most interesting was that of J. Rowland Bibbins. In this paper, an abstract of which is presented herewith, Mr. Bibbins stressed the importance of encouraging in our cities a broader perspective of relative necessities, the need for better facts, closer technical studies and closer coordination between the local agencies involved.

It is not in a critical attitude that I raise certain questions but if possible to unearth some plain facts about safety and signals.

What Are Signals For?—To promote order and safety?—Yes, but why not speed also? It can be done.

To decrease pedestrian hazard? Yes, if so designed with cycles neither too long nor the crossing intervals too short, so that people will obey them.

To increase capacity and speed? Yes. Sometimes it is necessary to signal for traffic volume, other times for speed, occasionally for heavy pedestrian traffic primarily.

To replace policemen? Not primarily, but if well-designed, they can be coordinated more efficiently than a series of independent officers. At critical traffic points we may need both signals and also police to control pedestrian and turning movements.

When Are Signals Useful?—When intersecting traffic becomes hazardous or gets tangled up by itself. This requires some kind of a standard to go by and much judgment. On light traffic streets, or during light traffic hours, they may be more dangerous than useful, because drivers disobey them. If rush hour densities require signals, then fixed or flashing amber can be used non-rush for caution signals, especially at night.

Are signals justified because an accident may have happened there? No. Signals where not clearly needed every day will encourage violation and increase accidents.

Does Traffic Obey Signals?—Speaking generally, yes; public service vehicles practically 100 per cent. But a considerable proportion of motorists jump the red-amber signals, which has given rise to the invisible two-color overlap period with the same clearance time. New York has educated motorists to stop at all streets between those signalled when the main street is open. So it can be done. The effectiveness of STOP signs has been questioned of late. But to me the main practical necessity is to secure a real slow down to safe control speed. I find this broadly true. The SLOW sign seems rather ineffective. Signals themselves are also violated, which is much worse.

Do Pedestrians Obey the Signal As Well?—Generally no, by no means. This is the great question today. In New York I found over two-thirds of the pedestrians violated the 2-minute red signals. Pedestrians will not wait for long signals but will wait for short ones. On the 1-minute red less than one-third violated

the signal. With a 30-second red the violation and hazard should be reduced to about 10 per cent.

What Are the Most Important Safety Factors?—

1st. The shortest possible length of cycle and red interval, consistent with the traffic density, and a design that will produce maximum through movement without stop.

2nd. On very wide thoroughfares, suitable refuge zones mid-street protected by mushroom markers or otherwise, are necessary to safeguard slow walkers. The pedestrian interval is the key to signalling on wide streets. Otherwise we shall lose in lowered capacity and efficiency much of the money we have spent for these great wide arteries.

3rd. Lane markings at intersections for both pedestrians and traffic to prevent meandering. I find many traffic authorities painting pedestrian lanes on a long diagonal across a wide street. This may require one-half more time to cross. Pedestrian crossings should usually be guided across the narrowest point, i. e., at right angles.

4th. Special pedestrian signals set low at eye-level vision, or else set low on signals posts, will probably be necessary, equipped with a positive indication of the end of safe crossing time. This requires 16 faces per crossing regardless of the traffic signals.

5th. Even so, police officers may be needed at many signalled crossings to protect pedestrians from themselves and handle traffic turns. There is no panacea for human nature, i. e., citizen independence, except the soothing syrup of normal psychology.

Do Fixed or Flexible Signals Best Suit Maximum Conditions?—Sheer necessity has demonstrated the necessity of flexible timing. I am considering the larger problem now and the distress relieved by the flexible progressive system on a long run or by the automatic demand type at some difficult intersection. High density traffic and transportation requires the highest signal capacity and efficiency, and the best is none too good. If we can set up the highest standard and demonstrate its value, general progress will quickly follow.

On a long run of heavy traffic street, the flexible progressive is now the only one even moderately approaching these essential requirements. These must be centrally controlled to vary cycle (and speed) according to traffic and weather conditions, and each intersection must be timed by itself so as to produce continuous non-stop progressive movement at a pre-determined speed and with least wastage of valuable street time for light cross movements. To install less efficient types under such conditions inevitably imposes an economic burden upon the community which may become disastrous to public transportation and disrupt established business and land values which require stability above all things for continued development.

The same principle is to be applied to a large traffic district of intersecting signal runs, known as the co-ordinated system, which simply means that all these separate signal runs are interlocked in time-step so that

traffic moves all ways in definite platoons with much the same freedom as it moves along a signalled artery. The initial installation of this coordinated system was made in the Chicago Loop District resulting in immediate increase in transit speeds up to 50 per cent and traffic speeds still more. Pedestrian movement is very heavy there.

Are the Simple Isolated or Synchronized Signals Justifiable?—For a long heavy traffic thoroughfare, bitter experience says no. There are a few cases of equal block lengths ideally spaced, but generally this system is too inefficient. On a 2-minute cycle it means that all traffic stops every 2,100 ft. at 12 m.p.h. or 30 times an hour, and shorter cycles make matters still worse. This produces so-called "congestion" which is really not congestion at all, simply the expected result of inefficiency.

The demand signal of "robot" is ingenious, approaching nearest to human intelligence, especially at a complicated intersection. But a series of demand signals cannot produce true progressive movement in the full sense as they simply follow the traffic procession from pressure of demand. They cannot lead the procession like a flexible progressive. But their great flexibility has further possibilities not yet fully developed.

We are coming, I think, by necessity to signalled express speedways as the only escape from approaching stagnation and to speed up public service, especially coach and trolley bus. These streets may more appropriately be signalled for speed and safety rather than for maximum volume primarily (the two are different). In the meantime the best possible combination of the two can be used.

The additional cost of the flexible progressive feature is so minor above that of the fixed timing, i. e., synchronized, or the staggered or alternate systems that there should be no question between the two. A recent system of alternate signals cost around \$1,000 per crossing, 4-post signals. The flexible progressive feature could be added for \$200 or \$300 per crossing additional, less if first installed.

What Determines the Success of a Signal System?—It depends entirely upon the design and timing. This is no place for "hit and miss" experimenting upon the public. The design should be worked out beforehand, based upon complete traffic analyses by a 5 and 15-minute period, rush hour and mid-day respectively, including all turning movements so that the timing down to seconds may be accurately set, and so that the signals will in fact pass the traffic without interruption or congestion. Each crossing must be studied separately and then coordinated with the others both for through and cross movements.

I have set up the following "bogey" as something to work toward. First, the minimum cycle length that will probably handle the traffic at the critical point or throat of a signal run and produce a reasonable speed along the street, which should vary for the central, intermediate and outer high speed zones. Second, the widest possible time band for through non-stop movement, which ought to be around 40 per cent of the cycle or 80 per cent of the GO time at the throat. Third, cross-town signal runs interlocked with the main runs to produce the same results for heavy cross-town streets. Fourth, all surplus cross time, not needed, to be thrown to the main street to accommodate delayed traffic, cars or buses, on the main streets and aid cut-in traffic from the side streets to get back into the procession without stopping. Fifth, all signal runs to be signed at the beginning of each speed section, e. g. "Speed 20 m.p.h."

by a small sign hung under the signal; this speed being the weighted average speed between rush and day hours. Sixth, all main street signal intersections to be laned for maximum traffic capacity and parking to be rigidly excluded near-side and for some distance far-side, especially opposite a safety zone. Seventh, minimum pedestrian interval based on 4.5 ft. per second walk, plus clearance period.

Will Corner Parking and Left-Hand Turns Interfere?—Both must be handled correctly to secure maximum signal efficiency. If a crossing is timed for 2-lane traffic each way, double parking and lax enforcement, especially near intersections, will obviously wreck an otherwise good design. Similarly the controversy over left-hand turns seems to have neglected entirely the fact that the outside turn, as still adhered to in Washington, not only blocks the cross-streets to right hand turns, but also takes 5 or 6 seconds out of the main street through time-band for the get-away. Many so-called "progressive" systems, especially with alternate synchronized signals produce a through time band of only 9 or 10 seconds so that this delay to through rolling traffic may take up half of the through time. When the center inside turns are used, this turning traffic is usually out of the way at the signal change.

Progressive designs hold the possibility of doubling or trebling the capacity of the street, doubling traffic speed, increasing transit speed, car/bus, up to 60 or 70 per cent and express bus speeds somewhere approximating traffic speeds. Conditions of course vary but analysis of Washington, New York and Chicago conditions alone show these possibilities.

Do All Intersections Along a Run Need Signalling?—In heavy density districts more signals are of course necessary, but even then some minor street can be skipped. For long arterial runs, I think many can be skipped. For some odd-blocks signals place an unnecessary handicap on an otherwise good design. Light cross traffic, short cross streets, dead ends and offsets often need only caution controls. Uniform block lengths may or may not work out, depending upon their length. There are very few ideal block layouts and almost never uniformly balanced traffic. Therefore the ideal to which these simpler types might be equally well adapted is practically unattainable. Varying block lengths are universal and the best design overall may require some skip signals. I believe this is justified even if some rush hour police are required at skip points to control pedestrians.

It seems to me that our main object should be the best overall design, all factors considered, instead of adherence to some arbitrary rule applied to one part of the problem. The main factor in designing rests upon a definite ratio—distance (feet) divided by 1.47 m.p.h. equals seconds to run, i. e., block spacings 10 per mile at 20 m.p.h. speed, require 18 seconds between intersections. This is inescapable. Just as skip-stops are being used advantageously in transit to increase speed, so also skip-signals are equally valuable in adjusting all the complex signal design factors in a street system. With some flexibility in signal location these appropriate speeds can be generally obtained along with non-stop movement.

By What Agency Do Most People Travel?—The main transit systems of our country handle a billion people per month or 33,000,000 per day. Whether by street car, trolley bus or motor coach is unimportant. This is 50 per cent more than all the passenger business of the Class I railroads of the United States. The 1930 population of our 93 cities over 100,000 is about

36,000,000 people, and that of the main traction centers about 30,000,000 people. The tractions thus move our entire city population once a day.

I observe with concern that public transportation seems to be discussed by most traffic men and city planners as a nuisance rather than a great essential utility. This is simply biting off our nose to spite our face. While it is true that in some cities of lax parking enforcement private automobiles handle perhaps half of the rush hour travel, in other large cities the proportion drops to 15, 20 or 25 per cent and in the largest cities where necessity riding occurs, 5 or 10 per cent. This indicates what real parking enforcement means to the majority. It seems time to get a better perspective of our major social needs when we are confronted with traffic controls and signal systems that reduce traffic speeds to 4 to 5 m.p.h.

What Traffic Density Requires Signals?—No absolute rule can possibly apply to all times and all conditions. But one can be applied with judgment and adjustment based upon the facts. I raise this mooted question as I have been misquoted in the following standard I used in the Washington survey:

For rush hours "signals will probably be required when the heaviest movement in the direction of main flow reaches a maximum rate of 500-1,000 per 15-minute hour rate, two lanes (i. e., 125 to 150 in 15 min.), giving due weight to cross traffic, turns, pedestrians and car-bus movements for the crossing as a whole."

For light hours. "When main traffic in any direction falls below about 100 for any of four consecutive 15-minute periods, signals may be shut down to advantage, except only in cases of unusual hazard. STOP signs or amber lights, steady or flashing, will provide protection."

Any standard requires detailed survey data by 15-minute intervals at least, better 5-minute intervals. For 15-minute traffic may be 20 to 30 per cent higher and 5-minute intervals. For 15-minute traffic may be 20 to 30 per cent higher and 5-minute traffic 40 to 50 per cent higher than for the full hour. Each crossing to be signalled should be analyzed in the same way. Then and only then can the best design be found, to give best speed, least waste time, shortest cycle, least stoppage and maximum pedestrian protection. It is not as simple a task as many seem to think.

Finally, What Can We Do for the Pedestrian?—When we reflect that all but 5 to 15 per cent of pedestrians come to town in cars, buses or autos we cannot play favorites in traffic regulations. For the harassment of being late to work by delayed cars and buses makes them take more chance on foot in violating signals. And when two-thirds of the persons crossing a heavy artery violate the signal, protection becomes a travesty. Here is a double opportunity for the application of practical psychology.

As a starter I lay before you exact information obtained from a study of 60,000 people crossing Upper Broadway, New York, and one of its main cross-town thoroughfares. "Actives" represent 84 per cent of the total, "Inactives" 14 per cent, and "Slows" about 2 per cent of this representative group. The time required to cross averaged 20.5 seconds or 4.86 ft. per second (3.3 m.p.h.) walking speed; "Active" men walked 5.3 f.p.s. and women 4.6 f.p.s.; "Inactives" walked 4.4 f.p.s. (3.0 m.p.h.); "Slows" 3.6 f.p.s. (2.4 m.p.h.)

Here is a typical problem of wide streets. The average group interval of 20.5 seconds crossing time represents minimum cross interval regardless of other factors. This street has a 20-ft. refuge strip down the

middle, giving perfect pedestrian protection for all Slows and Inactives to use half-crossings instead of full crossings. But in spite of this the traffic authorities rejected any signal design that would not provide for full crossing of the slowest walker plus clearance time, i. e., at least 35 seconds at every cross street, light or heavy, regardless of the refuge zone. This is a walking speed of only 2.9 f.p.s. (or 1.95 m.p.h.). The interval is three-fourths greater than the average, and nearly one-half greater than the time required by "Inactives." As a result the best possible signal design based upon this crossing interval necessarily wasted an enormous amount of street time to no purpose whatever. It is clear that the basic walking speed of 4.5 f.p.s. would be quite reasonable here.

This is the heart of the problem. Should the signal system be designed for protecting the 97 per cent or for the 2 per cent who can always fall back to full protection in the refuge zone? If the majority is to control, using half crossings at some points for those who walk slowly, a very efficient signal design for Broadway can be produced on the non-stop flexible progressive plan yielding a large increase of street capacity, traffic-transportation, efficiency and greater safety, even with New York's short street spacing north and south. I leave to you the choice between the results of arbitrary rules and what I consider rational high-efficiency designs. City planners advocating wide thoroughfares should also be concerned.

How Can We Apply Psychology to Decrease Violations—As one horn of the dilemma we have so-called human rights, at the other modern efficiency. Police regulation demands *stop*; traffic-transportation demands *movement*. I believe the two can be adjusted, for both have the same great objectives. This solution rests on the length of cycle and the signal timing. In New York at this time all main traffic was stopped one minute out of every three, or one-third of the time; cross streets were stopped two minutes or two-thirds of the time. In Chicago, Michigan Boulevard traffic north of the River stops every 100 seconds or 35 per cent of the time; south of the River about every 150 seconds or 40 per cent of the time, thus producing what I call a "cycle jam" or maximum congestion every 150 seconds. In Washington one important business street has five different cycles in seven blocks. (This can all be cured by the flexible progressive system. Usually with one Master*).

Fortunately, in New York, both long and short intervals were available for this study of psychology. The survey recorded in detail two groups of crossing pedestrians:

1. Those obeying the signals, i.e. crossing only on Green GO.
2. Those violating the Red STOP signal which traffic and transit has to obey for pedestrian protection.

The second reveals what I term the hazard Factor.

In spite of this positive protection the great majority of pedestrians, two-thirds in fact, violated the Red STOP signal. The curves, "percentage violations" are based upon these two signal intervals. But as we know fairly well the zero point and the fact that with longer intervals most everybody would violate the Red, we are fairly certain of the curves within the limits shown.

Here is the important point—that as the RED interval is *shortened* the violations *decrease much faster* than the actual reduction in time. This is the psychological key to the signal safety situation, especially on all wide thoroughfares. For a heavy crosstown thoroughfare,

*Washington Signal-Survey 1929, made for Washington Traffic Council.

more people violated the signals all day as the traffic density was less than for a main high speed artery, where violation was more hazardous (rush hour). On a given street the per cent violation appears to remain fairly constant a. m.-noon-p. m. rush. But comparing one street intersection with another on another street is liable to give variable and obscure results because of differing traffic, street widths, transit movements, safety islands, business density, etc.

We may now find a measure of the hazard factor by the relative violations *per second of Red interval*. As the cycle is shortened from 2 minutes to one minute and below, the hazard curve drops off rapidly to zero. While the precise results below 40 or 50 seconds should be studied more carefully, it appears that with a 20-second Red the total violations would be perhaps only half that for a 30-second Red and the latter only about one-third of that for a 60-second Red, etc. Here is evidently a major problem for research.

Roadside Planting in Connecticut

Highway beautification work conducted by the Landscape Division of the Connecticut Highway Department during the current year included planting of 1,363 trees, numerous shrubs, vines and wild growths along the highway rights of way. Luther M. Keith, department tree warden, is supervising the work.

The tree planting operations were conducted under two separate contracts. Under the first contract, 669 new trees were set out chiefly in the southwestern sector of the state, the tree planting activities of the Division alternating between the eastern and western areas each year. The principal trees planted under this contract were white elm, sugar maple, white ash, pin oak, silver maple, weeping willow and Norway maple. The second contract called for the replacement of 694 trees which have died or have been destroyed in one manner or another since the highway beautification work was started in 1926. This planting was fairly widespread throughout the state. The dead trees were replaced with trees of the same species. They are chiefly elm and sugar maple.

Beautification work other than the tree planting is conducted by employees of the Landscape Division. Most of the shrubbery set out has been cultivated in the five highway department stockyards at Wethersfield, Wilton, Ellington, Putnam and Essex. For some time past, the department has been collecting in these stockyards various growths natural to Connecticut, the location of the yards having been planned advantageously from the standpoint of making these collections. The growths are cultivated over a period of two years after which time they become sufficiently rugged to be transplanted along the highways.

Bare slopes resulting from earth cuts in the construction or reconstruction of roads are being covered with the more beautifying types of vines after being properly fertilized. These vines include Virginia creeper, honeysuckle and rambler roses. The department is also experimenting with the use of low shrubs for this purpose.

Rock gardens, built during the winter months, were planted with flowering growths, and tree pruning for the purpose of opening up views previously screened by foliage was carried out throughout the state.

Several new picnic spots along the highways were cleared during the winter and were equipped with tables, parking spaces off the highway and waste barrels.

The Landscape Division is also engaged in the work of seeding the extreme shoulders and banks wherever new roads have been built during the past two years, this being required by the statute through which the beautification work is made possible. All new construction of the current year was also carefully watched in order to save native growths for future use instead of permitting them to be eliminated in the course of construction work. These growths were transplanted to the stockyards where they will be carefully cultivated for two years and then replanted in the most advantageous locations.

Pavement Designs Will Be Tested by Bureau of Public Roads

To determine the relative efficiency of concrete pavements of several designs and to develop a more exact knowledge of the amount and distribution of stress in pavement slabs resulting from loads applied to them at different points, the U. S. Bureau of Public Roads has constructed a number of full-size concrete pavement slabs at the Experiment Farm of the Department of Agriculture at Arlington, Va. The slabs will later be subjected to an elaborate series of tests.

Some slabs will be of uniform thickness throughout. Tests on these are expected to furnish information regarding the relation between loads applied at various points and the stress and strain of the concrete at all points in the loaded cross-section, and the relation between load resistance and slab thickness.

Other slabs will be thickened at the edges and for a certain distance from the edges in accordance with the different designs now in use in several states. In some slabs the thickening will be provided for by excavating the subgrade under their edges. In others the surface of the concrete slab will be raised at the edges so as to form a low, rounded lip curb. In still others the lip curb will be combined with a thickening of the edge of the slab at the bottom. Observations of these sections will furnish information regarding the relative load-resisting properties of designs now in use in various states.

The test slabs, which will be 20 ft. wide by 40 ft. attention to the effect of edge thickening of transverse joints. The object of one test is to determine the efficiency of various methods in use for transferring load across these joints.

Other experiments will include bond tests of dowel bars to determine the length of embedment necessary; the measurement of subgrade friction, with particular attention to the effect of edge thickening of transverse joints on resistance to the sliding of the slabs on the supporting surface, and the measurement of the movement of the slab in the subgrade as a result of temperature and moisture changes. The work of constructing the slabs has just begun, and the concrete will be laid in late summer.

ROADS AND BOOKS.—A traveling library mounted on a specially-constructed motor truck loaned over 60,000 volumes in Monroe County, N. Y., last year. Over a million people are to be served throughout the state in this fashion, according to present plans.

Constructing Contraction Joints in Concrete Pavements

Improved, labor-saving method devised on Wisconsin state-aid paving job. Planes of weakness cut by one man with simple apparatus. Appearance of job improved by use of new device

By T. C. THEE

Assistant Highway Engineer, Division of Management, U. S. Bureau of Public Roads

DURING the course of some recent production studies by the division of management of the Bureau of Public Roads on a 20-ft. state-aid concrete paving job in Sheboygan County, Wis., the following labor-saving improvement on the original method of constructing the contraction joints was devised.

Contraction and expansion joints were placed alternately at a distance of 80 ft. between joints of the same type. When the studies were begun the contractor was forming the plane of weakness for the contraction joint by driving light V-shaped metal strips into the green concrete with wooden mallets. These metal strips were then left until the concrete had

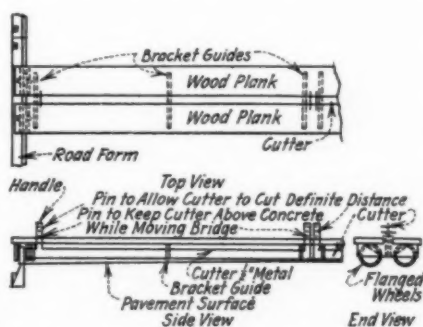


Fig. 1—Top, Side and End View of Cutter Bridge for Contraction-Joint Construction

set sufficiently for the final finishing of the joint. This method of procedure was simple; unfortunately, however, not only were strips hard

to drive but it was also seemingly impossible to drive them in satisfactory alignment. An effort was therefore soon made to devise a method which would produce a better looking job with the expenditure of less time and labor.

The apparatus finally developed consists of an ordinary wheeled bridge provided with a metal blade or cutter made up in two 10-ft. sections, each $\frac{1}{2}$ in. in thickness and provided with a vertical bar welded to each end. These blades are so constrained and guided by brackets that they can move only in a vertical plane. The vertical bars project above the bridge and are provided with a hole about $1\frac{1}{2}$ in. in diameter at the top end of each for inserting



Fig. 2—Apparatus as Originally Developed

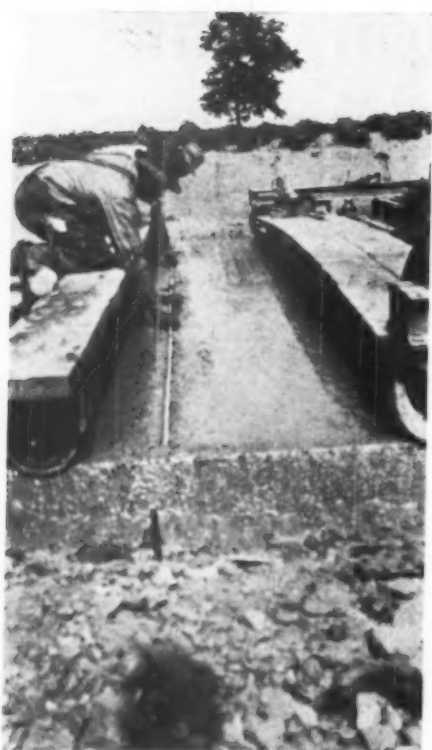


Fig. 3—Inserting Metal Strip in Groove Cut by Apparatus

a wooden handle, and lower down with two $\frac{1}{4}$ -in. holes—one for inserting a pin to hold the cutting bar clear of the pavement when not in use, the other to limit the depth to which the bar will cut when in operation.

With this simple apparatus one man can readily cut the plane of weakness by simply removing the metal pins which hold the bars clear of the pavement as he proceeds across the bridge, alternately lifting

and dropping one end of the metal cutter and then repeating the same operation at the other end of the bar. On the return trip over the bridge the bars are raised clear and the metal pins replaced and the cutting of the plane of weakness is completed. The bridge is then moved ahead or back sufficiently to permit the easy insertion of the light V-shape metal strips to maintain the shape of the notch until the concrete has set sufficiently for the final finishing, when they are removed. The original strips which were driven into the concrete with mallets and were continued in use were only 5 ft. in length. Ten-foot strips would be better and their use would save some time. The pavement is 20 ft. wide.

Figure 2 is a view of the apparatus as originally developed. The three vertical bars along the middle part of each cutter were intended as driving points in case it should be found necessary to use a driving force to make the cutter penetrate the concrete. Experience, however, soon demonstrated that no driving was necessary. Simply lifting and dropping one end of the bar at the time would quickly secure all the penetration needed. Figure 3 shows the metal strip being inserted in the groove cut by the apparatus. This strip is simply to maintain the shape of the notch while the remaining surface finishing operations are performed and until the concrete has set sufficiently for the final finishing of the joint. The strip must therefore be pressed well down so as to be a trifle below the actual plane of the

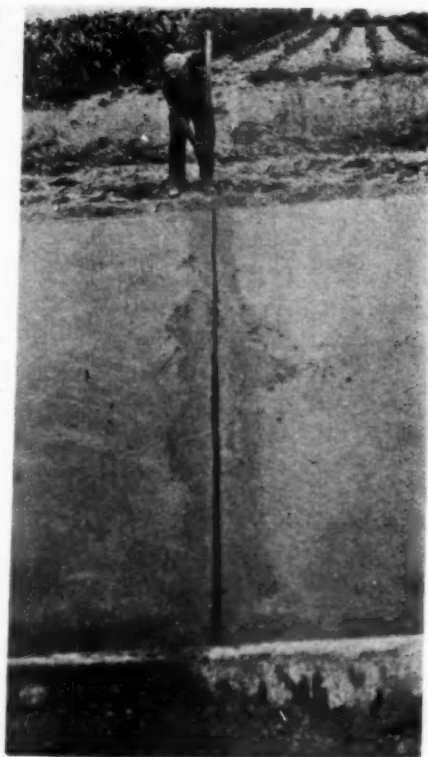


Fig. 4—Joint Immediately After Removal of Metal Strips and Before Hand Finishing

surface; otherwise it might be displaced by some of the finishing equipment. Figure 4 shows the appearance of the joint immediately after the metal strips are removed and before any hand-finishing has been done. The man in the background is shown cleaning one of the 5-ft. strips which he has just removed. Figure 1 shows the general construction of the apparatus.

Foreign Engineers Inspect U. S. Highways

More than 3,000 miles of paved roads in the United States were inspected by highway officials and engineers, official delegates from 60 nations of the world following the close of the Sixth International Road Congress in Washington on Oct. 11. Three tours were arranged by the Highway Education Board in cooperation with state highway departments, whose officials acted as hosts to the groups passing through their respective states. These tours were separate and distinct from the highway Congress and were planned solely for their educational value.

The tours were laid out upon a highly practical basis. The first embraced the industrial regions of America where foreign engineers had an opportunity to learn how roads are built and maintained to keep pace with the movement of traffic by day and by night, all the while increasing in density and weight. The first tour, therefore, was arranged to pass through the states of Connecticut, Massachusetts, New York, Pennsylvania, Ohio and Michigan.

The second group of foreign highway officials was routed over highways built to serve the agricultural needs of the Southeastern states. These include, Virginia, North Carolina, South Carolina, Georgia and Florida, where road requirements are similar to those of other states and countries in the same latitude.

The third tour was selected to cover roads serving a more or less mixed traffic in the transport of live stock, grain, coal, factory and other mid-west products. These include the states of Minnesota, Iowa, Illinois, Indiana, and Michigan, where road requirements are in keeping with all other states in the upper regions of the Mississippi Valley, and with foreign countries in the same latitude.

The tours converge at Detroit, the world's automotive center.

DRAG ROADS WHILE WET.—Gravel drags best while wet. Road dragmen should take advantage of rains for smoothing gravel roads. Get on to earth roads with drags and maintenance equipment before the surface dries too hard. Proper maintenance at the proper time often fixes a road for the rest of the season.

EDITORIALS

Why the Gasoline Tax Should Not Be Diverted

FOUR states are diverting a considerable part of the gasoline tax for other purposes than roads. Texas and Florida use 1 ct. per gallon of the tax for school purposes; and this amounted last year to \$5,579,000 in Texas and \$5,004,000 in Florida. Georgia diverted \$1,457,000 of the gasoline tax in 1929 to the schools. Louisiana diverts 1 ct. per gallon of the tax for schools and for port bonds.

The gasoline tax is essentially a toll for the use of the highways. It corresponds to the charge that a city makes for water that is metered. In rare instances cities have diverted water revenues to other uses than operation, maintenance, enlargement and improvement of water works; but we do not recall ever hearing a single good economic reason for such diversion of water revenues. Indeed it is so obviously uneconomic, as well as unfair, that rarely would any one even attempt to defend the practice of using the revenue from a waterworks plant for purposes other than those that relate to that plant. It follows, therefore, that it must be equally uneconomic and unfair to divert the revenues derived from the use of highways to other than highway purposes.

Perhaps there would have been less inclination to divert gasoline taxes had they been called road revenues instead of taxes. Legislators have been so long accustomed to look upon a tax as being a levy whose source bears no relation to its ultimate use, that it has been natural for some of them to regard the gasoline tax as being only another way of raising money for public purposes. It calls, therefore, for some study of the peculiar character of the gasoline tax to see clearly that this tax should not be classed with ordinary taxes.

We have said that the gasoline tax is economically sound. It is so because it so closely resembles a charge for a service rendered. The old toll roads were objectionable mainly because of the nuisance of stopping every few miles to pay the toll. This was nuisance enough in the horse days, but it became unbearable when the motor car arrived. Then the problem was finally solved by putting the toll on the fuel that motor vehicles use, in addition to a license fee. In the electrical power industry it has long been recognized by rate experts that the ideal charge consists of two parts: (1) a ready to serve charge, and (2) a current consumption charge. This is precisely the form of the prevailing charge for the use of the roads, the annual license fee being the "ready to serve charge," and the gasoline tax being the "consumption charge" that depends approximately upon the amount of use that the taxpayer makes of the highway.

Having thus devised a relatively equitable form of charge for the use of the highways, it is positively unfair to divert any of the revenue thus derived to other purposes. What would be thought of a city that diverted revenues secured from the sale of water to the building of pavements? Rightly would the water users object to paying for pavements in this manner, and they would not be straining the meaning of the word fair, if they denounced as unfair any such practice.

By the same reasoning it is unfair to tax road users as such for the purpose of paying the salaries of school teachers.

A Few Thoughts About Essayists

AN essayist in a recent issue of *Scribner's Magazine* said: "Theories are neither true nor untrue but merely everlastingly discussable." And he seemed to be serious when he said it.

We imagine that few of those that talk thus of theories have ever attempted to define one. A scientific theory is nothing more nor less than an explanation. So, too, is a detective's theory of a given crime; it is his explanation of the criminal act. Are all such theories of crimes false? If so, no criminal would ever be detected. The same holds true of scientific theories. If all were false, scientists would never have laid their hands on physical causes. Is there neither truth nor untruth in the heliocentric theory by which Copernicus undertook to explain the motion of the planets? Is there neither truth nor untruth in the theory of universal gravitation by which Newton undertook to explain the orbital motions of all the heavenly bodies? Is there neither truth nor untruth in the atomic theory by which Dalton sought to explain the quantitative merging of atoms into molecules?

It needs only a few such questions to make evident the falsity of the quoted statement about theories. Yet many essayists in our best general magazines are often guilty of writing just such absurdities as this one.

In another issue of the same magazine another essayist charges engineers with being too well satisfied with their science. He says: "Yet the more one reflects upon the machine, the less important do its practical achievements seem. * * * Instead of distributing leisure, our modern industrial societies are burdened with chronic unemployment, a curse and not a benefit; and when, to keep the wheels moving, it forces its ephemeral goods upon the market, it only turns the laborer into a goods-devouring mechanism, the victim of a servile system of consumption." So we are damned if, by economic machine production, we put goods within the reach of all, and we are damned again if we try to sell the "ephemeral goods" that we have produced. Perhaps the seal-blubber of the Esquimaux, the rice of the Chinese and the huts of the Hindus are less ephemeral, and their lot happier. Perhaps!

There is a type of mind that delights in denial. Let it be said, as Hoover recently said, that Americans have reached a higher standard of well being than has ever been attained before, and you will soon hear howls of denial. "But look at the industrial depressions that occur periodically in America," they cry. Yes, look at them, and while looking at these mild and brief slumps from our usual full time employment for all who want to work, take a look at the industrial depressions that are perpetual for more than half the population of the globe. Those perpetual depressions are confined to the countries where "the machine" is still a stranger, where very few engineers ever find employment, and where inventors are unknown.

The most elementary sort of reasoning should serve to show the falseness of the charge that mankind in general has suffered losses as a result of the invention

of machines. Even the essayists in question feel the weakness of their own arguments, for they are given to using most of their allotted space in talk about esthetics. The machine age is an ugly age, they tell us. By the way, what age was ever beautiful? Every ugly tenement district in our large cities can be matched by an uglier group of abodes in countries where the term "machine age" would be mumbo-jumbo. Beautiful spots there are in all countries. Beauty does not dwell only where men are beasts of burden; nor does beauty flee at the approach of science and machinery.

However, let us not take our essayists too seriously. Now, as always, their self-appointed task is mainly to disagree with commonly accepted beliefs. So long as they voice their disagreement in language that is good, and in ways that smack a bit of novelty, editors will accept their stuff, readers will read it, the while that they swear at it. Like caged beasts we enjoy being teased. It gives us reason for roaring.

H. P. Gillette

The Sixth International Road Congress

ONE of the most striking features of the International Road Congress which was recently concluded in Washington, D. C., was the lack of freedom of individual expression in convention sessions that so characterizes our American convention procedure. So far as actual technical or educational value derived from such sessions is concerned, one wonders if it is obtained. Every proceeding is "cut and dried." The papers which were presented were printed in the four official languages and distributed several weeks before the Congress convened. The only discussion allowed on those papers were amendments to the conclusions. Each country's delegation spoke through one of its delegates, voicing the combined opinion of the group. Consequently, conclusions and decisions were of the broadest character.

Each session was governed by a chairman who put the motions and controlled proceedings. However, before any conclusion or decision was finally worded it had to be entirely acceptable to another party, the General Reporter. This method of handling the conferences and translating the ideas into conclusions was very commendable. The American Organizing Commission deserves a great deal of credit for the manner in which all details of procedure were worked out. Confusion was non-existent even though sixty different countries were represented.

One of the novel features of the method of procedure in conducting the sessions was the way in which everybody present could follow what the speaker was saying no matter in which language he spoke. The four official languages were French, Spanish, German and English. The seats in the assembly or session chambers were divided into four groups according to language. If a delegate was speaking in German, those in each section would get his speech in their own language through an earphone headset. Each seat was provided with an earphone. The speaker would talk into microphones before him. Sitting at a long table immediately in front of the speaker were interpreters. These expert linguists would follow the speaker's remarks with less than a full sentence lag; each interpreting the speech in the other three languages. This important detail of the procedure was more responsible than any other one

thing for the interest maintained in the sessions.

Undoubtedly considerable value was derived from contacts that the various official and unofficial delegates made. Perhaps it would not be amiss to state that the time spent in personal conferences and individual or small group discussions constituted the most valuable part of the entire week. Certain it is that these sessions tend to produce uniform conceptions or ideas for definite terms used and thus make it possible for more free interchange of ideas.

V. P. Brown

Conclusions of the Sixth International Road Congress

TO highway engineers in the United States the conclusions of the Sixth International Road Congress may seem elementary.

This may also be true of those in foreign countries who have closely followed highway research and practice throughout the world. But those of us who have learned these fundamental, though elementary facts, through years of experience realize that fifteen years ago we would have welcomed the clear, general conclusions agreed upon at this congress.

The fact that discussion of these conclusions was concentrated on a few relatively unimportant points and that minor divergence of opinion existed, proves that these conclusions were correct and that the delegates for weeks in advance of the sessions were thoroughly familiar with the contents of the reports and their conclusions.

The remarkable success of the convention and the smoothness with which each session proceeded are largely due to the foresight and hard work of the American Organizing Commission and its engineer secretaries.

The convention procedure of the Sixth International can be studied to advantage by those responsible for convention activities in this country.

State Aid to Counties

THE problem of financing secondary highways in counties by State Aid is being satisfactorily solved by some states in much the same manner as Federal Aid to states made possible the construction of trunk highways.

The usual source of state funds for this purpose is the popular tax on gasoline, and its distribution to counties is administered by the state.

State highway funds are generally in an improved status due to the recent increase of federal aid allotments and to the increasing revenues from gas taxes without a change in the rate of taxation.

Recently other states, among them Illinois, Minnesota and North Carolina, have increased their gas tax rate to provide state aid to counties.

A readjustment of the fiscal relations in many states between state and county highways will result in decided benefits for both systems, and a study of the administrative and engineering policies for these secondary roads will result in better and cheaper highways.

V. P. Brown

County and Township Roads

A Section Devoted to the Interests of Those Responsible for Secondary Road Improvement



The Standard of Maintenance of the Roads of a County Is, Generally Speaking, Proportional to the Degree of Freedom of the Highway Organization from Political Control

Politics and Highway Maintenance

A plea for the elimination of political interference in the selection of highway officials and employees. Economical highway transportation calls for permanent highway organizations and high standards of competence. Taxpayers bear burden of useless high cost of political changes

By LEON F. WALKER

County Superintendent of Highways, Crawford County, Ill.

THE greatest need today in the maintenance of county highways is more efficiency and economy in the expenditure of public funds. The first requisite in securing efficiency and economy in county highway maintenance is that the work be directed and supervised by the trained engineer without political interference and control. Political interference and control always mean inefficiency and waste. People will have to learn that highway maintenance must be removed from political influence, if they are to receive the same efficient service in highway transportation which they now receive in railroad and other forms of transportation. Whenever people awake to the realization that efficient and economical service cannot be rendered when officials and employees are changed every time that a new political organization comes into power,

and demand that these officials and employees be retained in their positions as long as they render efficient service to the public, and vote accordingly, then only will people receive full value for their tax investment in highway transportation.

In this age of increased efficiency in all lines of business and industry, it is full time that citizens of this country should demand the same amount of efficiency in the expenditure of public funds. No railroad could long operate if, every few years, all officials and employees connected with the maintenance department were suddenly ousted, and their places filled with new and inexperienced men. Yet this is exactly the way in which the lines of highway transportation are being maintained in many parts of the country today. The average highway user either does not know that the

maintenance of highways requires trained and experienced engineers and a permanent organization of experienced employees, or else does not realize that the degree of efficiency with which a road is maintained makes a vast difference in the cost of motor-vehicle operation. If the motorist could keep a record of the operation cost per mile over various kinds of road surfaces, he would soon learn that a poorly maintained highway causes a big increase in this cost, and he would be interested at once in obtaining efficient maintenance service. He would be vitally interested in seeing a permanent maintenance organization formed which would not be disrupted every few years by political changes with added expense to himself and fellow road users.

Whenever the men who are interested in the welfare and progress of the community in which they live will get together and demand that candidates for public office shall be men who are qualified for the position and who are willing to serve unselfishly the public interests instead of men who are seeking public office merely for personal gain and power, then government can be organized on a sound economical basis and reach the same high standard of efficiency as that already reached by business and industry. That the power of political control can be broken is being proved by the steady growth of the city-manager plan in city government, until today there are more than 400 cities in the United States operating under this form of government free from political control. County highway maintenance must likewise be freed from political control, but this will not be done until men having influence in the community become sufficiently interested in good government to take active steps for its accomplishment.

There are still many people who honestly believe that the political spoils system is a necessary evil of our party form of government. The truth is that the spoils system is a necessity only to the self-seeking politician, and the sooner people realize this truth, the sooner the system will be abolished. In its last analysis the spoils system is a convenient means of paying for votes out of the public treasury. And the public official who discharges an experienced employee who is rendering efficient service to the public, and replaces him with a new and inexperienced man for political reasons is just as guilty of the misuse of public funds as if he took money out of the public treasury and transferred it to his personal bank account. It is true that the inexperienced political appointee renders some measure of service to the public for the salary paid him. But is that service as efficient as it would be if his appointment depended primarily upon the quality of his work? And how much does it cost the public to remove an experienced and efficient employee every few years, and to train and educate a new man to fill his position? The answer to the last question would be startling information to the taxpayer, if it were figured out in some instances. To what can less efficient work and cost of training be charged, unless it be charged to the purchase of votes or political support? No system that results in the waste and inefficiency which the spoils system does can be right, and a system that is not right had better be abolished. Until highway maintenance is allowed to operate free from political interference and control, and free from the spoils system of appointing officials and employees, the highway user cannot receive the efficient and economical service to which he is rightfully entitled.

Revolving Construction Fund Has Worked for Five Years

Marquette County, Mich., has used this plan for township roads and bridges with gratifying results since 1926

By JOE L. LONG
Associate Editor

AFTER submitting the article that appeared in the October issue, suggesting state aid for local roads by means of a revolving construction fund to be loaned without interest over a period of years for the construction of local roads through county road authorities, we learned that Marquette County, Mich., had used substantially this plan and wrote to K. I. Sawyer, for many years county highway superintendent at Ishpeming, for details. We submit his interesting answer in full:

Answering yours of the tenth relative to aid by the county to townships in the form of a revolving fund:

Acting under provisions of the Michigan statute known as Act 202 P. A. 1925, this county cooperates with the various townships in this manner. We have created a special fund for cooperative work with townships. On such roads as in our estimation the assistance is warranted and where the road is not apparently of sufficient importance to be a county road the county will enter into an agreement with the township to build the road and pay the cost thereof in the first instance, the cost ultimately to be divided on a basis of the county paying 25 per cent of the cost and the township paying 75 per cent of the cost. This agreement sets up a method for reimbursing the county for the 75 per cent of the cost to be borne by the township and this is arranged in a series of annual payments commensurate with the ability of the township to pay. The payments on this 75 per cent when returned to the county go into this special fund and are used in conjunction with the appropriation for that fiscal year for further cooperative work.

We make identically the same arrangement with the townships for the construction of bridges with the exception that in the instance of a bridge the county pays 50 per cent and the township 50 per cent of the cost ultimately, but as in the case of the road we pay the entire cost in the first instance. We also provide by contract for a suitable period, for the reimbursement by the township to the county on bridge costs. This system has been in effect for about five years in a modest way and has accomplished a great deal of good especially in the construction of bridges of suitable strength and character in townships which were not financially able to build this type of construction out of current funds. The county makes no charge for interest provided the payments are met on time in accordance with the agreement.

That a revolving construction fund should be created by each state where similar needs exist would seem to be rather self-evident. That it does and will greatly stimulate local farm roads is equally apparent.

That it will not interfere with any other programs of highway betterment but merely complement them is the opinion of those who have given the matter serious study.

IOWA PAVING COSTS.—Pavement projects recently completed in Iowa have cost an average of \$26,184 a mile. Costs for various items are reported as follows: aggregate, 13.2 per cent; cement, 22.4 per cent; reinforcing steel, 3.5 per cent; freight, 21.1 per cent; grading, 7.7 per cent; miscellaneous contractors' costs, including profits, 26.2 per cent; engineering and other charges, 5.9 per cent.

A Systematic Plan for Developing the Roads of a County

By NORMAN A. BLANEY

Director, Farm-to-Market Road Department, American Farm Bureau Federation

THE people of this nation have realized that the construction and maintenance of roads is an essential part of their economic program and must be regarded as a necessity to their future developments. This is very clearly shown by the data in Table I. However, the expenditure of such amounts as shown by this table should call for very careful study on the part of those officials who are responsible for expenditures, and under whose jurisdiction even the least amount is expended. Fortunately, those men who have developed the state system have, for the most part, devoted a great deal of time and thought to the planning of their funds so that the most economic results have accrued. This has been the case also in a fair number of counties, but not to such an extent as with the state system. Consequently, the result has not been as great.

Certainly, before any corporation, no matter how large, would consider increasing its investment by one-tenth of the amount spent annually in county and township road building, the most minute detail would be investigated and proved to be an absolute essential. Why should this not be done by each and every county and township? The majority of these funds, in counties and townships, are under the control of elected officials and although they may have decided upon the road improvement necessary to that county, unless the plan has been definitely agreed upon over a period of years, much of the expenditure they approve will not be of as great benefit as they intended unless their tenure of office is long enough to permit completion of the plan. They may be followed by men, equally honest, equally conscientious and equally public spirited, yet with totally different ideas on the road requirements. In such a manner even the most honest and loyal men will be the cause of uneconomical expenditure of taxes, against their own wishes. Furthermore, this activity and execution of this plan should be placed under the immediate supervision of competent engineering ability.

Most obviously, then, it becomes essential that the counties and townships give some thought to the developing of a plan to provide for their future road-building activities. The plan need not be elaborate and should be such that changes in detail would not be difficult nor impossible. Most decidedly, the efficient man-

ner of assuring that funds utilized for building roads shall be spent wisely and with the utmost economy is to begin with a comprehensive plan administered under competent engineering supervision.

Four problems face the road-building officials in any given territory:

1. On which roads should the money be spent?
2. What are the correct types to build?
3. How can the building be made progressive so that money spent and the work done will not be lost in the future?
4. To construct such roads as will most judiciously and economically be of the greatest use to the community.

In some instances it may be proved advisable to change certain locations. Existing roads were not originally laid out with a view to the most economical construction but were designated as roads and became used as such because they were the most natural lines to follow and the lines of least resistance. No county today could set about from an economic standpoint to develop an entirely new system of roads. The present existing roads must be taken into consideration in every instance. This, however, is an asset and not a disadvantage as in the majority of cases the existing roads have developed to meet the increased demands of the people and some of them can quite advantageously be included in even the most scientific and comprehensive plan.

A review of actual statistics of road-building activities reveals the fact that a township, as a separate individual unit, does not have taxing ability to provide an income sufficient to carry on road construction and maintenance in a manner which will be the most economical for the taxpayer. Under these circumstances, more efficiency will result by adding the township's road income to that of the county and providing for representation of each township on the committee which is to decide the road-building program of the county. Each township should have representation on the committee conducting the investigation or analysis.

After the analysis has been made and the road requirements of the entire county have been decided upon, each section of the county having been taken into consideration, regardless of township or any other political or taxing boundaries, the final plan must be approved by the voting taxpayers of the county as a whole, if the plan is to be entirely satisfactory. This plan, and the entire proceedings of analysis should be open to the public at all times. It can be explained at public meetings during the actual analysis. The committee itself should take the attitude of a jury, before which anyone can express his or her views, or make any suggestions which are likely to prove of benefit.

Analyzing the County

It may be regarded as an accepted fact that very few counties are identical in their requirements for roads.

TABLE I

1929 expenditures, estimated.....	\$1,435,410,068
1925 to 1929 inclusive, average.....	1,290,110,892
1929 gas tax.....	430,208,273
1929 motor-vehicle tax.....	374,177,629
1929 federal contribution.....	80,830,336
1929 other taxation.....	577,193,330
1929 approximate expenditure on state highways.....	694,992,695
1929 expenditure on county and township roads.....	740,417,363
1929 road mileage improved as shown by U. S. B. P. R. report.....	25,071
1929 county and township road improvement by same report.....	29,804

¹Includes interest and principal payments on bonds not paid for by gas tax and vehicle fees.

However, fundamentally, there are similarities in all of them.

A county which is purely agricultural and which specializes in the production of grains, for example, which are shipped to other regions either by rail or by road, and which does not contain within its borders any area of concentrated population, will certainly have a different requirement for roads than the county in which a large commercial city is located, or the county which has one or more cities with population of from 50,000 to 250,000 people.

Before it is possible to develop a plan for road construction, existing conditions must be analyzed, and, from the analysis, the road requirements of the county must be decided upon. The task is, of course, much more simple when a county is the unit in question, than when the plan must be made to serve a state or the entire nation. That the making of the plan for any county is relatively simple is all the more true in this country owing to the fact that the main arteries of travel are included in the plans of the state highway departments. The state systems have been designed, in the vast majority of cases at least, to accommodate the bulk of the traffic and to join together the principal cities. Consequently, the county plan should be designed so that the outlying territories will have access to the main highways.

The most simple manner in which the problem can be treated is for a group of fair-thinking, public-spirited citizens to associate themselves together as a committee to make such an analysis. When the necessary facts have been gathered together, it is not a difficult task to decide upon the road requirements, or, in other words, to decide just what roads are necessary for the carrying on of the business, social and economic life of the county to the greatest advantage of all concerned. To be of the greatest value, all question of politics must be omitted and also all question of personal gain or advantage.

A road is built, or should be, so that the people in the territory through which the road passes may be able to maintain an economic communication with people in other territories, so that they will be able to transport their merchandise to market, so that they will be able to bring in from other localities those things which are not produced in their own locality and which are needed by them, so that they will be able to avail themselves of the economic and social benefits which are required to maintain their standard of living. The road plan should be laid out with a view to facilitating this communication, merchandising and buying of necessities with the greatest economic possibility.

There are, however, other factors which do not enter into the commercial side of the situation, which should be taken into consideration from an economic standpoint. Among these must be included that of providing educational facilities for the children in the community. It is a universally recognized fact that the consolidated or union school, which derives its maintenance income from a larger territory than is possible with a one-room school, can provide better educational facilities because of that greater income. The problem of transportation is perhaps the greatest single factor preventing consolidation of school districts. The consolidated or union school naturally must draw from a much larger territory than the one-room school; consequently, the distance between the rural home and the school is greater. From this it can be readily seen that before the rural children are to be in a position where they can receive

the greatest good from this superior type of school the transportation facilities must be taken care of.

There is also the matter of loss to the rural owner through fire. It has been estimated that this loss totals approximately \$150,000 per year in rural United States. Some time ago Maj. Gen. George O. Squire, U. S. A., ret., developed a plan for providing motorized fire equipment in each township. The need of such a plan is obvious. Such a plan cannot be developed without roads which can be used during the spring, fall and winter seasons, during which times the fire loss is greatest.

The principal factors which must be taken into consideration are commercial products (agricultural and manufactured types), where produced, how and where marketed; natural resources of commercial value, location, where and how marketed; location of schools, cities and towns, mail routes and other related factors, such as existing roads and their degrees of improvement; community growth, income, taxation and indebtedness. In view of the fact that without commercial economy there can be little or no social activity or benefit it would appear that the commercial aspect is of primary importance.

Actual counting of existing traffic may or may not be of importance or value. It must be recognized that the bulk of traffic will naturally move along an improved road in preference to an unimproved road, even though the latter be considerably longer. The quantity of the traffic, both as to numbers and types of vehicles which should use any particular road, may not be revealed by conducting traffic counts. This can be ascertained only by analyzing the production of the territory. The distance between two points, under present conditions, with only part of our roads improved, is not of as great importance to the traveling public as is the element of time required to reach the destination. Consequently, the actual counting of the traffic, to be of value, must in its final analysis, take into consideration the origin, destination and directness of route of that traffic.

Method of Analysis

In order that the committee may not become confused with an elaborate discussion on the data which should be secured and the manner in which the information should be compiled for most ready analysis, the separate steps are stated, and follow:

1. Obtain a map of the county on which all the roads in existence are designated (such a map may usually



A Fit Subject for Immediate Consideration



The Question Facing Us Today on County and Township Roads

be obtained from the county engineer or surveyor's office). If one is not available, a rough outline of the county should be drawn and the existing roads marked on it.

2. By means of special marks such as small circles, crosses, broken lines, etc., show the different types of improvement on each road.

3. The state highway system should be marked.

4. The areas in which the natural resources of commercial value, such as minerals, oil, coal, etc., are located should be marked on the map.

5. Agricultural production should be marked also. The different types of products can best be shown by using different colors; for example, the area in which hay is mainly produced, by one color; another color will show the dairy producing territory; others for grain, vegetable gardening, fruit, etc.

6. Mark the locations of cities, towns and villages, railroad lines and any special or particular market points.

7. The location of factories producing the different kinds of manufactured articles produced in the county, such as furniture, clothing, fertilizers, etc., if marketed or shipped by truck, should be noted. Different colors will be useful to show each kind and how much tonnage is shipped by road.

8. Designate the locations of schools with special notations as to size of school (the school district served by each of the schools should be marked).

9. Mail routes should be outlined.

It may be found necessary to use one map for agriculture and natural resources, another for manufactured articles, mail routes, schools, etc., so as to avoid a confusion of data. Portions of maps of adjoining counties may be necessary in studying market points or places of specific interest.

This information will enable the committee to determine what would be the most economical route between the source of each individual product and its particular market. In the ultimate analysis, however, it will be found that the various individual most direct routes for any one product will need to be merged together so as to provide the greatest transportation for the greatest volume of product with the least number of miles of road.

New Jersey established the first state highway department in 1891.

Report Form for Maintenance Work

A combined time card and cost record card for the county maintenance force that has given very satisfactory results is used by Frayne L. Combs, County Surveyor, Wapakoneta, O. These cards are so arranged to take care of every class of work that the Maintenance Force is called upon to do. All of the time and materials used are recorded on the front of the card and the cost recapitulations are carried on the reverse side of the card. The foreman over the labor crew reports his time and also all of the helpers' time on the front of one card together with all materials and supplies used by him and the data on the operation he is performing. Thus one card serves for a complete labor crew. This card likewise serves for bridge painting crew, etc. Each operator of a truck or a road maintainer or other individual piece of machinery records their operations on a separate card, together with all other data pertaining to materials and supplies used by them. Thus the cost for each individual machine is kept. By using these cost cards the engineer has been in a position to show the county commissioners what is most economical type of machine to use for the various operations.

This Side for Office Only				Item Cost
HAULING COST				
Drivers Time	hrs. @			
Gal. Gas used	@			
Qts. Oil used	@			
Est. Machine Dep.				
Cost of Helpers if used in Opr.				
Miscellaneous Item used cost				
Total Cost of All Items				
Length	Miles	Total Cost	Cost Pr. Mile	
Haul				
ROAD SCRAPING & DRAG COST				
Drivers Time	hrs. @			
Gal. Gas used	@			
Qts. Oil used	@			
Est. Machine Dep.				
Cost of Helpers if used in Opr.				
Miscellaneous Item used cost				
Total Cost of All Items				
Length	Miles	Total Cost	Cost Pr. Mile	
Road				
LOADING & UNLOADING COST				
Gal. Gas Used	@			
Qts. Oil Used	@			
Est. Machine Dep.				
Labor Cost carried Fr. other side				
Total Cost of All Items				
Materials Handled		Total Cost	Unit Cost	
GUARD RAIL OR CULVERT COST				
Labor Cost Carried Fr. other side				
No. Post used	@			
Rail Cable or Wire used, Ft.	@			
Culvert or tile used, Ft.	@			
Miscellaneous Items used cost				
Total Cost on All Items				
Lin. Ft.		Total Cost	Unit Cost	

Back of Report Card

Check Weather: ☐ clear ☐ cloudy ☐ showers ☐ rain
DAILY REPORT MAINT. AND REPAIR GANG
 SURVEYOR'S OFFICE, AUGLAIZE COUNTY

Workman's Name	Title			Date	19
Time Employed From	M.	to	M.	Hours.	
Machine Driven	No.	Miles Driven			
Kind of Work Done					
Total Amount of Material Hauled					
Material Supplied From					
If From R. R. Car give car No. and Initial					
Gal. Gas used	Quarts Oil used				
Where Gas Purchased	Where Oil Purchased				
HELPERS REPORT					
Names	Material Used	Kind Work	Hours	Rate	Amount
Remarks					

Front of Card Used for Daily Report of Maintenance and Repair Gang (Actual Size 6 x 4 in.)

BEFORE



The Quakertown-Cherryville road in Hunterdon County, N. J., was one to be avoided before its improvement, especially during the rainy seasons of the year.



Motorists formerly found that even slow progress along this Burlington County, N. J., road required constant vigilance.

AFTER



Traffic hastens along the road since it has been improved with a wide gravel surface. Drivers have a feeling of security.



Residents of Hunterdon County as well as visitors benefit from the improved all-weather road between Quakertown and Cherryville. The surface is penetration macadam.



Machines Facilitate Wayne County Maintenance Work

Pictures from R. H. STEKETEE

*Maintenance Engineer, Board of County Road Commissioners,
Wayne County, Mich.*

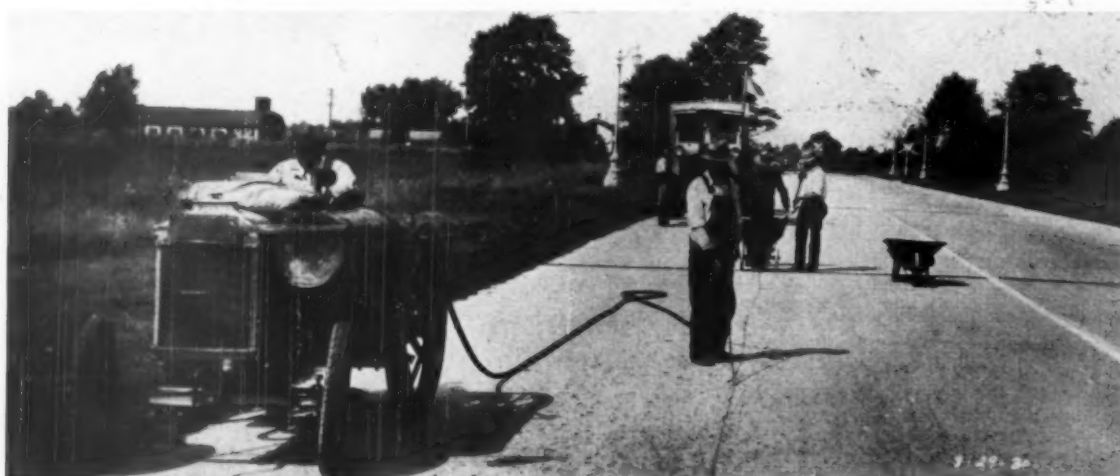
A large pile-driving hammer, operated by air and mounted on a truck, is used for breaking up concrete where settlement has occurred and concrete patches are necessary. This has proved a very economical method for breaking up the old concrete in sizes that can be handled easily



The expansion of concrete pavement in warm weather forces the joint material out and forms a ridge on the surface of the pavement. The removal of these ridges of bituminous material is necessary to provide smooth-riding qualities for the road, and this machine was devised as a labor-saving method of doing the work



This machine fills the cracks and joints with bituminous material and spreads the sand immediately behind. A neater and more permanent job is obtained by its use



An air compressor mounted on a Fordson tractor is used for cleaning out joints prior to sealing them with bituminous material. By using this equipment, a better seal is obtained, resulting in a more lasting job

Iowa Demands Good Market Roads

Farms must be connected with market by 365-day-in-the-year roads as measure of economy and prosperity for everyone. Middle-west press considers relative economy of types of low-cost surfaces; favors year-around roads

By JOE L. LONG

Associate Editor

WITH less than 1 per cent of untillable land, Iowa presents a perfect example of the vital importance of continuous marketing facilities to the farmer as well as those who buy his products, and in return sell theirs to him. All over the state this question is taking precedence over all others, stimulated greatly by the recent trunk-line construction of some 3,000 miles of 18-ft. concrete roads.

Perhaps some of the editorials from recent issues of a few Iowa papers will indicate not only how intensely earnest is the desire and demand for such work and how important is the proper provision for financing the construction work.

The Wellsburg *Herald* in a long editorial headed "Isn't It About Time to Begin to Figure on Secondary Roads" asks a few pointed questions as follows: "When will these fellows ever wake up to the fact that the first duty of any Iowa legislator is to put the farm on the road map. Why this refusal to see that the road starting at the farmer's door is the road that Iowa needs most? Now that Iowa is supplied with roads for the tourists, the buses and the truck drivers, why not give the farmer a chance?" The editorial makes a very definite and logical declaration in conclusion: "With the very prosperity of the state in the agricultural development, it would seem that it was time to wake up. Let the secondary roads—the farm roads—have their fair share of the road money."

The Dubuque *Telegraph-Herald* of Aug. 9 discusses the question, "What Is a Low Cost Road?" so ably that we reproduce the editorial in full.

At the present time many of our states have started on intensive secondary road building programs designed to provide agriculture with year-around contact with its markets through the medium of paved, weatherproof highways.

Obviously, secondary roads of this type cannot be constructed by the same expensive methods as main highways. Yet they must be practical and long-wearing. Too many localities have considered first cost only in designing so-called "low-cost" roads, disregarding the equally important factor of maintenance.

A study by the Washington State College discloses that tire wear is four or five times as great on crushed rock and gravel roads as on bituminized surfaces, and a report of the Iowa State College shows gasoline consumption to be 25 per cent higher. In addition, maintenance costs of gravel or rock are often excessive. Though such roads are cheap in the first place, they are not entitled to the classification of "low-cost."

It has been the general experience that an asphaltic oil road surface is the most efficient, economical and best-wearing per dollar in rural communities. Initial cost is somewhat higher than gravel or rock and maintenance cost lower. The savings in gasoline consumption, tires and wear and tear on vehicles will often more than pay for the difference in a short time.

Farms must have year-around roads. Every state should carefully investigate to find the surface material that will give the best results for the lowest cost over a period of time, so that progress can be achieved in solving the problem of farm-to-market roads.

We hold no brief for any particular type of construction for low-cost roads, but believe that some practical method can and should be worked out. The results of experiments along this line should be watched by the local highway authorities everywhere.

Because the appended editorial from the Rockford *Register* of Aug. 13 makes an enlightening comparison of various types and also discusses the ever-annoying "washboard" of gravel roads, it should be of special interest.

A Road Problem Direly Needing Solution

Within the past fortnight the *Register* man has had occasion (it would be out of place to say privilege) to drive over several score of Iowa's gravel roads and as many in the state of Minnesota, and some 300 miles of pavement and tar-surfaced roads in the latter state. Naturally after such an experience one is prone to draw comparisons between the three types or kinds of roads named. It is putting it mildly to say that the gravel suffers badly in the comparison. It is true that the first cost of gravel roads is considerably less than either of the other two; but in the long run, covering a period of from fifteen to twenty years, there is good reason for the belief that the gravel road is the costliest of the three. Moreover, there is universal agreement that it is the poorest of all from the standpoint of pleasurable utility. There is not only the drawback of dense dust-clouds when traffic is heavy, but the wash-board wave tendency on most gravel roads largely destroys the enjoyment one might get out of traveling over them. They are one stage better than at times impassable dirt roads and that is about all that can be said for them. At times on some of these gravel roads this washboard wave or corrugated tendency is unspeakably disagreeable. It would seem to be putting it mildly to say that state highway commissions as well as other boards upon which devolve the upkeep of gravel roads have no more urgent or important task on their hands than ascertaining the cause or causes of this undulating or corrugated condition of these gravel roads and then forthwith proceeding to cure this defect. Opinion seems to be divided as to the cause of the corrugated condition referred to. Some contend that it is due to the use of the roads by heavy freight and passenger cars. Others quite intimately acquainted with road work, particularly those who have done grading work on gravel highways, hold that it is due to the use of too light graders and especially to the fact that the blade of the grader is held at too near a right angle to the road. In other words, such outfits seek to cover too large a section of the road in each trip. There is reason to believe that were the grader blade held at a more acute angle to the line of the road there would be less tendency to produce the condition referred to. The *Register* has it from men who have spent years in dragging gravel and dirt roads that this is the major cause of the washboard wave in gravel roads. If this be true, in the name of common decency and highway comfort, why not have the men whose duty it is to drag the roads cover half as much road space in their trips and do the job twice as well? As things stand, they put in their time and the roads they cover are almost never in decent condition. In any event it is up to the state highway commission, which in Iowa has control over all roads, to see that this condition is corrected. Taxpayers of the state pay entirely too long a price for the care of gravel roads to have them in so unspeakably rotten a condition so much of the time.

Iowa's road problem will not be fully answered until every productive farm is connected with its market center and therefore with the main highway system by a road that can be traveled in safety and comfort every day in the year.

Exactly the same conditions apply to all other productive farming communities and today this is a paramount social and economic question in which every citizen of the United States has a direct and personal financial interest.

The Road Builders' News

An Outstanding Example of Highway Engineering

The Mount Vernon Memorial Highway, now in the course of construction on the Virginia bank of the Potomac River, was presented in model form as an outstanding example of American highway engineering, at the American Road Builders' Association Exposition, which was held at Washington in connection with the Sixth International Road Congress.

This model, displayed by the Bureau of Public Roads of the U. S. Department of Agriculture, was completed last spring, and displayed in the basement of the Capitol for inspection by members of Congress. It is an exact replica on a miniature scale, of two important sections of the Memorial highway; one, at the base of the railroad and highway bridges, showing the proposed overpasses, and the other, at the Mount Vernon terminus. It gives an excellent bird's-eye view of the project at these points, accurately reproduc-



ing the parking and landscaping scheme, with model trees and grass plots lining the right of way.

The entire exhibit, covering a large area of floor space and occupying a central position at the exposition, was viewed from an elevated platform over which visitors passed.

Extending $15\frac{1}{2}$ miles in length, with a minimum right of way of 200 ft., except through the city of Alexandria, the Mount Vernon Highway will be part of the George Washington Memorial Parkway, and will rival the country's greatest boulevards in scenic beauty and historic interest.

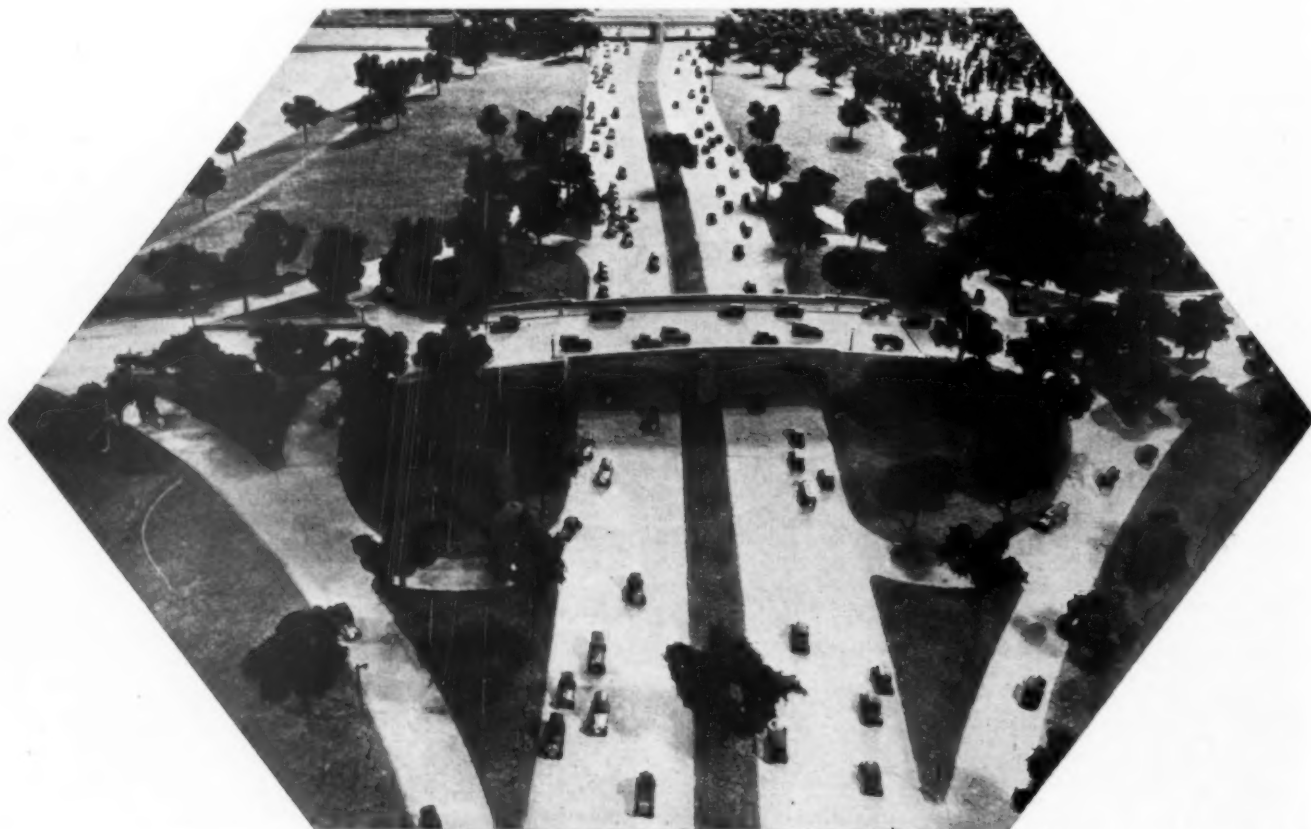
In addition to the highway model, the Bureau of Public Roads presented an educational exhibit demonstrating the generally accepted practices in the new science of sub-grade soils. Roads are no longer

built from the ground up, but the ground itself is studied, treated, and prepared, in order that the most suitable pavement bases may be obtained under all conditions. Many phases of the subject have been explored, and the work has brought to light information of immense value to the highway engineer. Endeavoring to hasten the adoption of the results already accomplished, the exhibit illustrates how the isolated discoveries of investigators in this country and abroad have been organized into a systematic and scientific method.

St. Louis, Hub of Highway Construction Activity

The trend of modern road building in the paths of America's pioneers is graphically shown in a survey of regional highway expenditures completed by the American Road Builders' Association.

With road systems well on their way toward completion in the originally settled eastern states, it is



Highway Grade Separation and Connecting Ramps at South End of Highway Bridge Over Potomac River on Mount Vernon Memorial Highway

pointed out that highway expenditures for 1930 while on the increase throughout the nation, reach their highest peak in the middle western states, most of which have the largest program of expenditures in history.

This is forcefully brought out by the fact that about 55 per cent of the estimated state and county highway expenditures in the nation lies in states within a 500-mile radius of St. Louis. Approximately \$888,000,000 is being spent in this area, while about \$713,000,000 is being spent outside it.

Only seven states outside this area show estimated expenditures of over \$25,000,000, while ten states within the prescribed radius have programs involving more than twice that amount for this year. Pennsylvania leads the list with an estimate of \$170,000,000. New York is next with \$145,000,000. Of the outside states, California leads the west coast with an \$80,000,000 program.

In the past few years, the central western region has followed somewhat slowly the road building lead set by the eastern states, but this year's activities prove that the people in those areas are no longer to be satisfied with anything short of completed system of primary and secondary roads. The increases in highway expenditures are contributed to largely by the aroused interest in improvement of county roads by state and local authorities.

County funds, as well as those of the state highway departments, are benefitting by the increasing revenues from gas taxes and motor vehicle registration and by the decidedly lowered cost of construction. The better types of roads now being built and the improved equipment have also decreased maintenance costs, thus releasing more of the budget for new construction.

It is most fitting that St. Louis, the hub of highway construction activity, has been chosen by the American Road Builders' Association for its twenty-eighth Annual Convention and Road Show, January 12 to 16, 1931. Here the enthusiasm set in motion by President Hoover in his plea for increased highway construction and which has met with hearty cooperation of state, city, and county authorities, will be concentrated in the meeting of all the various branches of the vast highway industry.

The International Congress and Exposition

Low cost roads and road financing were the topics of chief interest in the Sixth International Road Congress and Exposition of highway equipment and materials, held at Washington, Oct. 6 to 11, in the opinion of W. A. Van Duzer, president of the American Road Builders' Association.

Van Duzer, who is assistant chief engineer of the Pennsylvania department of highways, attended all the business and social activities of the world wide gathering of road builders, in his capacity as a member of the Permanent International Commission of the Permanent International Association of Road Congresses of Paris, France, and as an official delegate of the United States to the Sixth Congress.

He regarded of particular significance the fact that official delegates from 61 nations assembled at the Congress seemed to have a unity of thought on the subject to acquiring more road mileage as rapidly as possible.

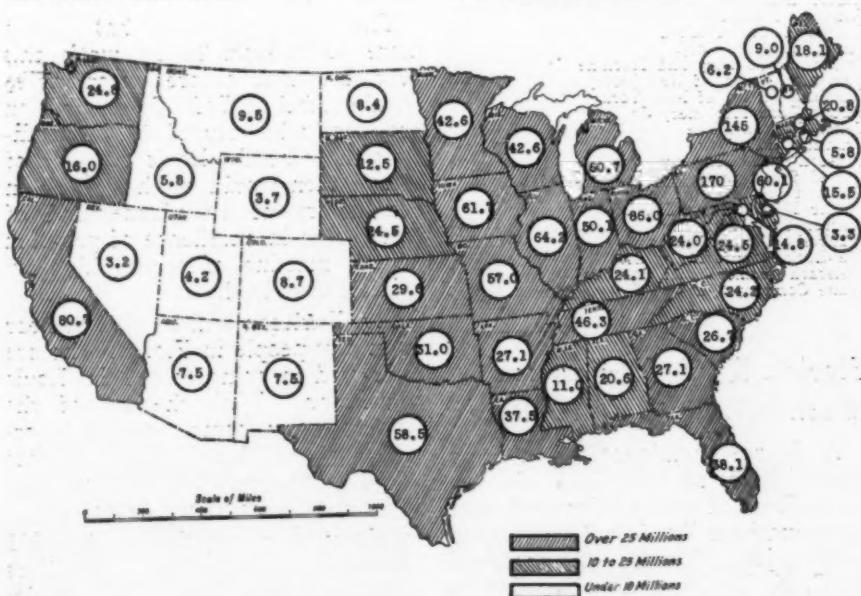
The congress sessions were held in two sections; one dealing with the engineering problems of construction and maintenance of roads; the other having to do with traffic and administration. The exposition was staged by the American Road Builders' Association. Exhibits of manufacturers and producers of petroleum products, graders, stone crushers and other materials and equipment for low cost surfaces; and model roads featuring stage construction, gave especial accent to the low cost studies.

Other machinery and materials on display were designed for use in the highest types of paving, in which American manufacturers and engineers have made such outstanding progress. There also were exhibits of traffic signals and signs and other equipment for highway maintenance and operation.

"In discussing road problems informally with many delegates, as well as the formal discussions in congress sessions," Van Duzer says, "the general opinion seemed to be that engineering research on road construction and maintenance has been of inestimable value to the highway field. While the United States leads in this work, many other nations are doing, and will continue to do, splendid research work."

"Traffic, which is engaging the attention of the entire world with its complicated problems which have arisen suddenly in recent years, came in for much attention, with the general conclusion that the thing most needed in that phase of highway operation is greater international standardization of methods of traffic control."

"However, highway use does not become a problem until highways are built; engineering depends on the type of road to be constructed; this in turn depends on the finances avail-



Estimated State and Local Highway Bridge Expenditures for Calendar Year 1930 Expressed in Millions of Dollars. (As Reported by the State Authorities)

These estimates were made previous to any congressional enactment increasing Federal Aid allotments and are exclusive of state road bond payments on interest and principal. It is estimated that on account of the recent Federal Aid enactment there will be approximately \$120,000,000 additional to the above figures spent throughout the United States.

able. It is taken for granted, that any highway agency which is entrusted with public funds will build the best possible roads, of the type justified by the present and anticipated traffic situation, and to the greatest mileage possible, looking toward ultimate completion of both primary and secondary systems.

"The Road Congress went on record that because of the investment character of improved highways, bond issues or other methods of borrowing for highway construction and improvement are desirable in most countries; that the period of amortization of loans for highway construction should not exceed the life of the improvement; that when the needs for expedited highway construction and improvement have been met, the use of bond issues should be discontinued and the pay-as-you-go basis followed.

"Our international visitors were amazed to learn of the \$930,000,000 motor taxes which flowed into our state treasuries in 1929 to swell the highway fund. No other nation has such possibilities of annual revenue, therefore they must make the dollars go to the utmost limit in providing roads for motor traffic, which will result in a similar tax income.

The delegation from Colombia, announced to the Congress that it was seeking the aid of American firms who would finance and build their road systems, with the government paying for them in installments from traffic income. Most of Latin America desires similar aid. European delegates told of fairly sound sources for the highway budget, but funds are limited there, also, and they must get great mileage of construction for limited cost.

"The manufacturers in the equipment and materials exposition were awake to these needs of foreign nations, and displayed for the Congress delegates the most modern of our developments along this line. The delegates will undoubtedly return to their highway work around the world with renewed optimism for the day when their completed road programs will be a reality."

The international gathering in Washington, afforded an excellent opportunity for the committees of the American Road Builders' Association to discuss their work and reports which are to be completed for presentation at the Association's Annual Convention and Road Show at St. Louis in January, 1931.

Exhibitors at the Washington Exposition were:

Adams Company, J. D.
Allis-Chalmers Mfg. Co.

Monarch Tractors Division
American City Magazine, The
American Gas Accumulator Co.
American Tar Products Company
Armco Culvert Mfrs. Association
Arundel Corporation, The
Asphalt Institute, The
Austin Manufacturing Co.
Automatic Signal Corp., The
Barber Asphalt Co., The
Barrett Company, The
Biehl Iron Works, Inc.
Black & Decker Mfg. Co., The
Blaw-Knox Company
Bradley Road Marking Co.
Bragg-Kliesrath Corp.
Bucyrus-Erie Company
Byers Machine Co., The
Caterpillar Tractor Co.
Centaur Tractor Corp.
Central Iron & Steel Co.
Clay Products Association
Clinton Motors Corporation
Colas Flintkote, Ltd.
Colprovia Roads, Inc.
Conant Machine and Steel Co.
Concrete Surfacing Machinery Co., The
Contractors and Engineers Monthly
Davey Compressor Co.
Dual Duty Sales
Edwards Manufacturing Company
Engineering News-Record
Euclid Crane & Hoist Co., The
Ford Motor Company
Galion Iron Works & Mfg. Co., The
Godwin Co., Inc., W. S.
Good Roads Machinery Co., The
Gurley, W. & L. E.
Hamilton Manufacturing Co.
Harnischfeger Sales Corporation
Hastings Pavement Company
Heil Company, The
Heltzel Steel Form & Iron Co.
Hercules Motor Corporation
Highway Service, Inc.
Hvass & Co., Inc., Charles
International Bitumen Emulsions Corp.
Irving Iron Works Company
Keuffel & Esser Company
Kinney Manufacturing Company
Kohler Company
Lakewood Engineering Co., The
McEverlast, Inc.
Metalweld, Inc.
Milburn Co., the Alexander
Motor Improvements, Inc.
National Equipment Corporation
National Paving Brick Mfrs. Assn.
Norma-Hoffman Bearings Corporation
Northwest Engineering Company
Olsen Testing Machine Co., Tinius
Pan American Petroleum & Transport Co.
Portland Cement Association
Ransome Concrete Machinery Co.
Reo Motor Car Company
Riddell Company, W. A.
Roads and Streets
Sawyer-Massey, Limited
Shell Petroleum Corp.
Southwark Foundry and Machine Co.
Standard Oil Co. of New Jersey
Standard Oil Co. of New York
Stroud Road Machinery Co.
Texas Company, The
Transit Mixers, Inc.
Truscon Steel Company
United States Bureau of Public Roads
United States Steel Products Co.
Walter Motor Truck Co., Inc.
Warren Bros. Company
Waukesha Motor Company
Wej-Lock Manufacturing Co.
Welsbach Traffic Signal Company
White Company, The

Florida Road Officials to Attend St. Louis Convention

A large attendance of Florida county highway officials at the St. Louis Road Show and Convention of the American Road Builders' Association, Jan. 10 to 16, was promised by C. E. Burleson, Pinellas County engineer, who has just returned to Florida from an executive committee meeting of the County Highway Officials Division at Washington.

In addition to executive committee membership in this national organization of all the interests connected with road building, Mr. Burleson is

a director of the division, and chairman of its important research committee on construction.

The various committees of each division carry on studies of certain phases of road work throughout the year, and present their findings at the annual convention session, as a guide to the best practices of modern engineers. The construction committee this year is studying particularly the construction of low cost roads and bridges, which is of particular interest in county road programs, and the widening, reconstruction, and resurfacing of highways. This latter work is of particular importance because of so many of the secondary roads, which do not meet the demands of heavy traffic of the present day, and these roads present a difficult problem of reconstruction, in addition to the new mileage which is continually being demanded and built.

Mr. Burleson was complimented by the president and other officials of the division on his active interest in county highway work, and for the excellent outline of the year's studies of his committee.

Prominent county officials throughout the nation are represented on the executive committee, and in the meeting at Washington, they were told of the growing interest in highway work, which is shown by the rapidly mounting expenditures for county road programs in every state in the Union.

The county division has shown more enthusiasm in its work this year than ever before, according to Stanley Abel of Taft, Calif., division president, who assured the other officials that the St. Louis meeting of county men would be the largest in the history of attendance, and of most value in excellence of program of any meeting of county highway officials ever held.

Mr. Burleson will be glad to hear from any people in Florida who are interested in going to the St. Louis convention. With the aid of the transportation committee, he is organizing special pullman and other travel arrangements for the comfort and convenience of the delegates.

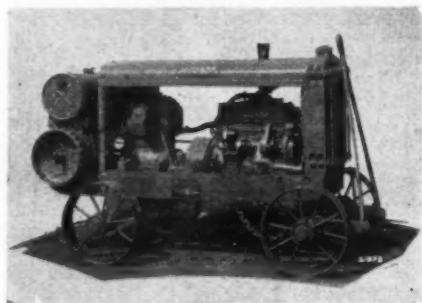
"From every standpoint, the 1931 Convention and Road Show promises to be an outstanding event," he declared, "and I am anxious to have Florida represented in the greatest numbers that have ever attended such a gathering."

Other studies of the county division this year include, Finance and Administration, Regional Plans and Surveys, and Maintenance.

New Equipment and Materials

Schramm Engine-Driven Compressor

The standard No. 72 Schramm compressor is a complete engine-driven unit embodying all the features found in larger Schramm outfits, and has a displacement of 72 cu. ft.



Schramm No. 72 Portable Engine-Driven Compressor

This size of compressor serves many purposes. First, it can be used as an auxiliary unit for replacing the larger compressors on work where only a one-tool outfit is needed; and second, it makes a good investment for the contractors who need only a small outfit for the occasional rock drilling, paving breaking, demolition work, clay digging, tamping, riveting and other work done by pneumatic tools on their jobs.

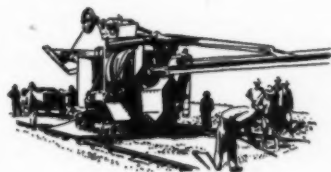
The outfit is completely housed with removable steel doors and equipped with extra-heavy A. S. M. E. riveted tank with fusible plugs, directly connected to the compressor by means of a heavy pipe with rugged expansion joints. The tanks are inspected and carry with them a certificate of inspection.

Monarch "35" with Wide Angle Track Shoes

New track equipment for the Allis-Chalmers Monarch "35" tractor includes the wide angle track shoes shown in the illustration. These shoes are built in 18 in. 24 in. and 28 in. widths and provide the extra traction needed for work in



Allis-Chalmers Monarch "35" with Wide Angle Track Shoes



unusually loose soil, in swamps, or on steep hillsides.

In addition to the wide angle tracks, the Monarch "35" can be equipped with standard tracks built in extra widths.

There is also a wide tread Monarch "35" now available in which the tracks are built further apart. This arrangement gives the tractor greater stability on steep hillsides or for use with such equipment as side boom hoists or cranes.

A Micrometer Rolling Parallel Ruler

A new drafting room instrument designed for many purposes, especially where accuracy of spacing is required, has been placed on the market by the Alpha Instrument Co., 2103 K St. N. W., Washington, D. C. A few of the uses for this ruler are:

Spacing and ruling parallel lines, logarithmic or trigonometric spacing and ruling, hatching, section lining, shading, marking accurately and rapidly the spacing for rivets, bolts, or railroad ties, in



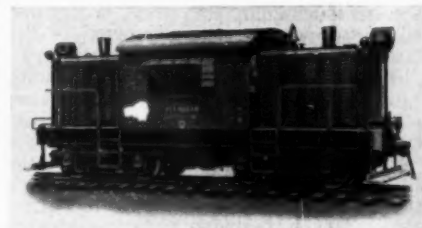
The Micrometer Rolling Parallel Ruler

drawings for steel work or railroad construction, accurately spacing for the P-T and P-C on railroad drawings; accurately laying out of coordinates as for drawing angles by coordinates and other purposes. In the accompanying illustration, A is a dial for reading spacing rapidly for greater distances; B-C is a worm gear with a dial at C for reading small or micrometer spacings. By raising B, one end of the worm shaft, the worm is disengaged and the ruler may be freely moved any distance and the distances or spacings read on the dial A. The dial A has on the ring surrounding it a zero line that may be set anywhere required to coincide with the zero of the dial when starting to space or rule. By pressing down on B the worm is engaged and then by rotating C micrometer spacing is accomplished and read on the dial at C. It is stated that with ordinary care in operation, spacing is made with an accuracy well within 1/1,000 of an inch.

By locking the worm B-C the ruler becomes rigid on the drawing board and triangles may be applied to the edge as with a T-square and the worm locked serves as a brake preventing the ruler from rolling off a sloping drawing table.

New Gas-Electric and Oil-Electric Locomotives

The Fate-Root-Heath Co. (Plymouth Locomotive Works), Plymouth, Ohio, has brought out a new line of gas-electric and oil-electric locomotives in a full range of sizes from 25 to 60 tons. The Model GEL 50-ton gas-electric is illustrated.



Plymouth Model GEL 50-Ton Gas-Electric Locomotive

This model is 31 ft. 4 in. long and 9 ft. wide. The frame is built of 15-in. I-beams and 9-in. girder beams, rigidly constructed, with cast-steel bumpers and bolsters. Two 4-wheel, spring-equalized trucks permit the locomotive to negotiate sharp curves and ride rough track with ease. It is equipped with two 6-cylinder engines, one in each end of the locomotives, developing 350 hp. at 1,000 r.p.m.; Westinghouse electrical equipment including two 105-kw., 500-volt d-c. generators mounted on the base with the engines; and four 110-hp. motors, two mounted on each truck.

The control of the engines, reversing, acceleration and speed control of the locomotive are accomplished from a single operating station. Westinghouse straight and automatic air brakes are standard equipment.

The locomotive has a tractive force of 33,000 lb. at 2 m.p.h., and a maximum speed of 36 m.p.h.

New 1/2-Yd. Convertible Excavator by Orton

A new small excavator has been developed recently by the Orton Crane & Shovel Co., Chicago, Ill. It is equipped with a 40-hp., 4-cylinder gasoline engine which is provided with an ac-



New Orton Model 4 Excavator

celerator arranged for both hand and foot operation, electric starter, oil filter, air cleaner and other modern accessories.

Power is transmitted by means of a multiple-disc clutch, the transmission shaft being mounted on anti-friction bearings. Connecting the transmission shaft to the propelling clutch shaft is an enclosed alloy-steel chain with floating take-up. By use of the engine clutch the double-jaw propelling clutches can be shifted as easily as a friction clutch of the gear type, and the traveling speed can be varied from $\frac{1}{2}$ to 3 m.p.h. A special main cutout clutch enables the operator to stop all of the machinery except the propelling mechanism when traveling, a decided advantage when going any considerable distance.

The treads are of the self-cleaning type, and are driven by heat-treated alloy-steel roller chains on large-diameter hardened sprockets, provision being made for take-up of both the treads and chains. Coil springs back up each set of treads, thus protecting the operating mechanism from undue strains and shocks, and distributing the weight of the machine uniformly on the shoes when traveling over uneven ground.

Steering is accomplished by a hand wheel in the cab, brakes being applied to either of the two differential shafts. The machine can be turned in a circle, the radius of which is equal to the center-to-center distance between the treads.

The shovel is quipped with a 16-ft. heavily-constructed and electrically-welded boom and a 12½-ft. electrically-welded dipper stick with numerous diaphragms. A special patented rope crowd does away with troubles incident to the adjustment of the length of the rope, and the dipper can be held in a fully extended position. Normal speed of the crowd is 85 ft. per minute.

The Model 4 excavator is readily convertible to shovel, crane, dragline, ditcher or skimmer, and changes to these attachments can be made in the field.

An extension of the cab for the operator's position gives a clear view of the work on both sides of the machine, and the levers are conveniently located. Each function of the Model 4 is controlled by a separate lever.

New 6-Yd. Wagon

The La Plant-Choate Mfg. Co., Cedar Rapids, Iowa, has brought out a new 6-yd. hydraulic dump wagon. The body is built entirely of steel, hot riveting and electric welding being used throughout its construction. The $\frac{1}{4}$ -in. side body plates are bent at the bottom to form the angle which is fastened



La Plant-Choate 6-Yd. Wagon

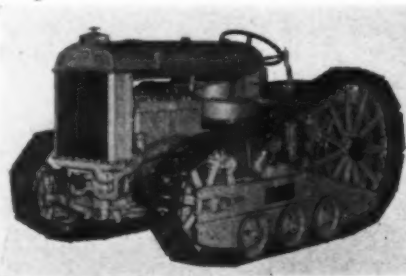
directly to the frame, giving the wagon the advantage of "one-piece" construction. The doors are $\frac{3}{4}$ -in. steel and are equipped with heavy angles riveted on for reinforcement. One of the salient features of this wagon is its balance. The upper edge of the body has a molding of $4 \times 3\frac{1}{2} \times \frac{1}{2}$ -in. bulb angle which prevents the body from spreading.

The frame is constructed of heavy angles, riveted and electrically welded throughout, and has double crossed members at both ends that take out all possible chance of twisting, while there are gusset plates on top of the frame, both front and rear, for additional strength. A $3\frac{1}{4}$ -in. round axle runs through the wagon frame, and on top of this axle is welded a $\frac{1}{2}$ -in. plate 10 in. high which is directly welded to the sides of the box. This prevents spreading of the body and frame.

The wagon has the hydraulic system for raising the doors. By simply shifting a lever convenient to his seat, the tractor driver can wind up the doors without stopping the tractor. The power is furnished by a simple rotary gear pump operated from the power take-off of the tractor. The wagon can also be obtained with a simple hand-winding mechanism, placed at the rear.

Crawlers for New Fordson Tractors

The Trackson Co., Milwaukee, Wis., has developed a new Model F Trackson



Model F Trackson Crawlers for the New Fordson

crawler for the new Fordson, which gives a track area of 1100 sq. in. contact with the ground.

The crawlers may be quickly and easily installed on the Fordson by any mechanic. It is merely a matter of removing the wheels and attaching the crawler, with no special fitting, drilling or machine work required. No differential changes are necessary and there are no intricate parts to complicate the steering or operation of the tractor.

The crawlers are built entirely of steel and have few working parts. The tracks are made of heavy electric alloy steel castings, heat-treated and hardened to provide extra strength and resistance to wear. The sprockets are made of special alloy steel. Positive protection against sand and dust prolongs the life of all bearings used in Trackson crawlers and the patented truck wheel bearings which carry the entire weight of the tractor are provided with a special oil reservoir and are of ring-oiling design, making lubrication certain and easy.

One-Man Graders for Monarch 35

Two new one-man graders have been adapted for use with the Allis-Chalmers Monarch 35 tractor by the Shaw-Enochs Tractor Co., Stillwater, Minn. One of these graders, the Century, is designed for both maintenance and construction work and can be changed into a two-man unit if desired. An unusual feature of this



Allis-Chalmers Monarch 35 with Century Grader

grader is its reversible controls. When the grader is used as a one-man maintainer, the controls are placed in front within easy reach of the tractor seat. For use as a two-man unit, the blade controls can be transferred to the rear of the grader in less than an hour's time and without additional parts.

The other grader, the Shawnee No. 2, is especially adapted to heavy maintenance and scarifying of city streets and roads having heavy traffic. With the Monarch 35, this grader may also be used by paving contractors as a sub-grade maintainer and grader to work ahead of the paver. This grader is also adapted to cutting form trenches. It develops a blade pressure up to more than 5,000 lb., depending on the size of blade and equipment used. It will handle blades up to 16 ft. in length. The blade is integral with the frame, and the entire frame is raised through crank axles mounted on Timken roller bearings. The blade is adjusted with large screws housed in seamless steel tubes, one telescoping over the other.

New Trackson Hoist

The Trackson Co., Milwaukee, Wis., announces a new model Trackson hoist, the HM, which is designed for mounting on the McCormick-Deering 15-30 tractor. It is essentially a heavy-duty machine, built for general, all-around hoisting usage and for hard, continuous service. There are many uses for this equipment in the construction and general contracting fields, some of which are as follows: hoisting concrete and other building materials, double elevator operation, dragline work in sand and gravel pits, backfilling, pile driving, steel erection, house moving, log skidding, land clearing, etc.

The Model HM hoist has extra cable capacity, improved screw-type clutches, oversize drum shafts, hand-lever control and a level-wind device that wraps the cable on the drum evenly and smoothly, layer after layer, eliminating kinking, tangling, etc. It may be obtained either as a single or a double-drum hoist and can readily be converted into the other type by merely mounting or removing the upper drum.



Model HM Trackson Hoist for McCormick-Deering 15-30

Also, the hoist can be purchased as a separate machine, or it can be ordered as a complete unit mounted on the 15-30 or Model 30 tractor. Installation on the tractor is an easy matter, since there are no holes to bore and no construction changes to make.

The patented Trackson level wind is an exclusive Trackson feature. It prevents the cable from criss-crossing or bunching up as it is wound on to the drum, thereby saving wear and tear on the cable. The level wind works at all speeds and can be adjusted to handle different sizes of cable.

Federal Enters 6-Wheel Field with Three Heavy Duty Models

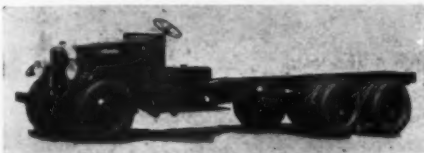
Federal Truck Co. entry into the six-wheel field is marked by the production of a group of three heavy duty, six-wheel, tandem drive units known as the U6SWAB and 4C6SW.

The Federal U6SW is rated at 6 tons and has a gross allowable weight of 28,000 lbs. It is powered by a 6-cylinder, 90 Hp. engine with dual ignition. Included in its specifications are 13-in. clutch, 7-speed transmission, 34x7 tires (dual rears—10 tires), inside frame reinforcements and outside fish plates. The braking system consists of 6-wheel, hydraulic brakes.

The full-floating, worm-drive, tandem rear axles are connected on each side by an equalizer bar, trunnion mounted to the springs to give individual vertical action and flexibility to the four rear wheels so that they may adjust themselves to road irregularities. Driving force is transmitted from one axle to the other by means of an interconnecting propeller shaft. Propeller shaft brake is mounted on the rear of the transmission.

The Federal U6SWAB is also rated at 6 tons with a gross allowable weight of 28,000 lbs. It is identical with the U6SW except that it is equipped with Westinghouse air brakes which apply on all six wheels.

The Federal 4C6SW is rated at 8 tons with a gross allowable weight of 34,000 lb. It has a 6-cylinder, 100 Hp. engine with dual ignition; 36x8 tires, dual rears (total 10 tires); inside frame reinforcements and outside fish plates. The rear axle construction and mounting is the



New Heavy Duty Federal Truck

same as the U6SW except that it is larger and of greater capacity. Westinghouse air brakes apply on all six wheels. Propeller shaft brake is mounted on the rear of the transmission.

Winsor Trailers for Allis-Chalmers Tractors

A two-wheel, heavy duty trailer has been designed for use with the Allis-Chalmers Model U industrial tractor by the Winsor Tractor Equipment Corp., Ann Arbor, Mich.

The trailer attaches to the tractor by means of patented, spring suspension ball and socket joints, clamped to the rear axle housing near the two drive wheels. This makes a six-wheel motor vehicle which handles loads up to 10 tons. If desired, a 10-ton 4-wheel trailer can also be pulled behind the 2-wheel trailer.

This chassis can be equipped with any type of body desired. Boxes for hauling sand, cement, gravel, etc., dump bodies, street flushers, road oilers and many other body types are now in use. The Allis-



Tractor Attached to Winsor Trailer

Chalmers tractor has a four-speed transmission and operates up to 20 miles per hour.

Tractor and trailer have a short turning radius which give them an advantage in city streets or on narrow driveways. The trailer is equipped with manual or vacuum brakes which are operated from the driver's seat on the tractor.

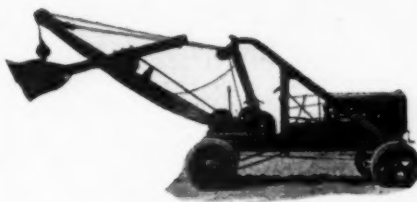
The Cranemobile

A new convertible machine—the "Cranemobile"—is now in production by Bay City Shovels, Inc., Bay City, Mich.

The Cranemobile is an adaptation of the Bay City crawler mounted tractor model. No change is made in the machinery, superstructure or booms and buckets. In place of crawlers heavy steel wheels with large solid rubber tires are substituted permitting faster travel speeds and eliminating crawler wear for long or fast moves. A special heavy duty forged Timken front axle is provided with roller bearings. Steering mechanism is provided under tractor end of machine. The Cranemobile is intended for any material handling job where a truck crane would normally be used or where a fast moving and operating machine is desired for work on hard or relatively smooth ground.

The tractor shovel is to be continued in production, as the Cranemobile is intended for another field of work, where hard surfaces conditions favor a rubber wheel mounted machine, rather than crawlers.

This machine is convertible and, in addition to standard crane attachments, such



Bay City Cranemobile

as clamshell, hook and block, electric magnet, etc., it is available with shovel dipper, trench hoe or skimmer bucket.

Three speeds forward up to seven miles an hour and one speed reverse are available.

Portable Steel Buildings for Contractors

A new development of the Genfire Steel Co., Youngstown, O., of interest to highway engineers and contractors is a standardized fireproof steel building, which can be moved from place to place without damage and which provides protection for tools and equipment at a low cost. The buildings can be erected in the field by unskilled labor, as the standard sections are assembled entirely by bolting. Flexibility of design permits any desired arrangement of doors and windows.

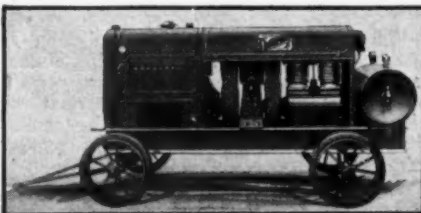
Air Cooled Compressors

An air cooled compressor has been placed on the market by the Davey Compressor Co., Kent, O. In this machine the compressor heads and manifolds are of special aluminum alloy, cast with deep fins to give greater radiating area. As a result it is claimed, that high temperatures generated inside the compressor head are instantly passed through the aluminum walls, preventing any possible "piling-up" of heat within the compressor. It is further stated that with such low temperatures there is no carbon formation, so the compressor valves do not become fouled.

The compressor delivers 142 cu. ft. of air per minute. They are furnished in four convenient mountings: one each for "Caterpillar" and McCormick-Deering tractors; one for trailers, and one for skids.

The tractor mountings have been very carefully engineered to avoid disturbing the operating balance of the tractor, and to permit its full use for drawbar and other work.

When thus mounted, the compressor is operated from a power takeoff from tractor motor. When mounted on trailers or skids, power is furnished by a Hercules motor, with transmission through two sets of V-type multiple belts which effectively absorb reverse torque action.



Davey Air Cooled Compressor

New FWD Trucks Announced

Four Wheel Drive Auto Co., Clintonville, Wis., announces the incorporation of two new models FWDs in its line of 4-wheel-driven trucks. These two moguls, known as the "Super-Five" and the "Super Seven," are respectively of 5, and 7½ tons capacity.

Both have wheel bases of 165 in., loading space behind cab of 156 in., and 72 in. tread. The 5-ton frame has an overall width of 32 in., and the Super-Seven of 34 in. Both frames are of heat treated, high carbon pressed channel steel, the 5-ton specifications calling for 8 x 3 x ¼ in., the 7½ ton 10 x 3 x 11/32 in., the chassis weighing respectively 11,800 lb. plus body weight allowance of 2500 lb.; and 13,000 lb. and 3000 lb.

Each has a 6-cylinder motor, developing for five ton, 102 b. hp. at 2000 r.p.m., and for the 7½ ton truck, 127 b. hp. at 2000 r.p.m. The cylinders in both motors, are of the removable cast-in-pairs, truncated, detachable-head design, while in the detachable cylinder heads appear the Ricardo combustion chambers. The manifolds are of the well-known Blue Flame type. The crankshafts with seven bearings, hang in exceptionally deep, rigid, girder type crankcases.

The selective sliding gear, four speed, main transmission in each, is supplemented by a planetary, two speed, auxiliary transmission; these give in combination, a range of eight forward, two reverse speeds, with direct drive in the eighth. The outstanding feature of the new, patented, FWD planetary step down gear is that it permits the use of a 12 in. silent chain instead of a series of gears. In high range there is a direct drive to the silent chain, with no moving parts in the planetary system while in action; in high gear the entire planetary unit rotates with the upper mainshaft of the sub-transmission as a solid flywheel keyed to the shaft. The design permits of removing the entire planetary system without disturbing the propeller shafts, the silent chain or sprockets. Gear ratios are 10 to 1.

Full floating, double reduction axles are used; the first reduction through a pair of bevel gears, the second reduction through spur gears. All of them are enclosed and protected from grit and dust; they run in a bath of oil. Two and one-half inch axle shafts rotate through front and rear axles, each of which has a capacity of 17,000 lb., and are interchangeable for right or left side of both axles.

The new, patented, steering arrangement of the front axle makes for the greatest steering ease. The entire front-axle load is carried on two massive tapered roller bearings at each axle end; they are designated as trunnion bearings.

The new roller mounted cam and lever steering gear, together with the 22 in. steering wheel, carefully located, provide the driver with passenger car steering comfort.

The center differential, a distinctive feature of all FWDs, and which compensates for the difference, under certain conditions, in the rotations between the front and rear axle shafts, is interposed between the front and rear propeller shafts.

There are differences in the brake systems. On each there is a four-shoe Tru-Stop emergency brake mounted on the hub of upper transfer case sprocket;

these exert positive braking action, through brake drums of 16 in. diameter, on all four wheels. However, on the "Super-Five," the service brake system is complete in the truck itself; it is the Bendix four wheel brake system operating in connection with a BK booster. In



New Model FWD Truck

the "Super-Seven," consideration is given to the probability of linking in brakes on trailers; consequently the service system is of the Westinghouse air type, operating on the rear wheels only.

Both trucks ride on semi-elliptic alloy-steel springs, 48 in. x 3½ in. forward and 52 in. x 4 in. rear; the "Super-Five" is mounted with heavy-duty balloons, 12.75 in. x 20 in., singles front and rear; the "Super-Seven" with pneumatics, 44 in. x 10 in., singles front, duals rear.

New Tractor Powered Shovel

A new tractor powered shovel having several new features has been brought out by the Michigan Power Shovel Co., Benton Harbor, Mich. In this machine the turntable and the boom are full revolving but the tractor power plant is stationary. Another feature of the shovel is the hydraulic clutch control which makes it possible to operate under the hardest digging conditions with very slight pressure upon the small control levers. These control levers are only 8 in. in length.

A third feature of the shovel is flexibility of movement. Steering has been simplified through the use of two hydraulically operated clutches mounted directly upon the ends of the rear axle shafts of the tractor. Pressure for the steering controls is furnished by a small rotary gear pump mounted upon the side

frame and driven by the tractor fan belt. This arrangement makes it possible to drive the machine independently of the turntable mechanism.

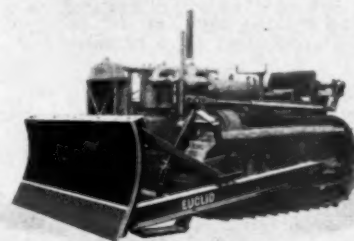
The new machine is so designed that any standard make of tractor can be used. It is equipped with a ¾-yd. dipper. The machine is also so designed that attachments such as cranes, clams and trench hoes can be used.

The weight of the shovel is 9½ tons. It has a maximum dumping height of 16½ feet, a maximum dumping radius of 19 1/3 feet, and a maximum digging radius of 21 1/3 feet.

Euclid Hydraulic Bulldozer

One of the most recent additions to the line of Euclid earth-moving equipment is the Euclid hydraulic bulldozer.

It is proving exceptionally valuable to earth-moving contractors on all bulldozing work. Light in weight yet unusually strong, embodying many exclusive Euclid features—including the specially designed hydraulic pump and



Euclid Hydraulically-Operated Bulldozer

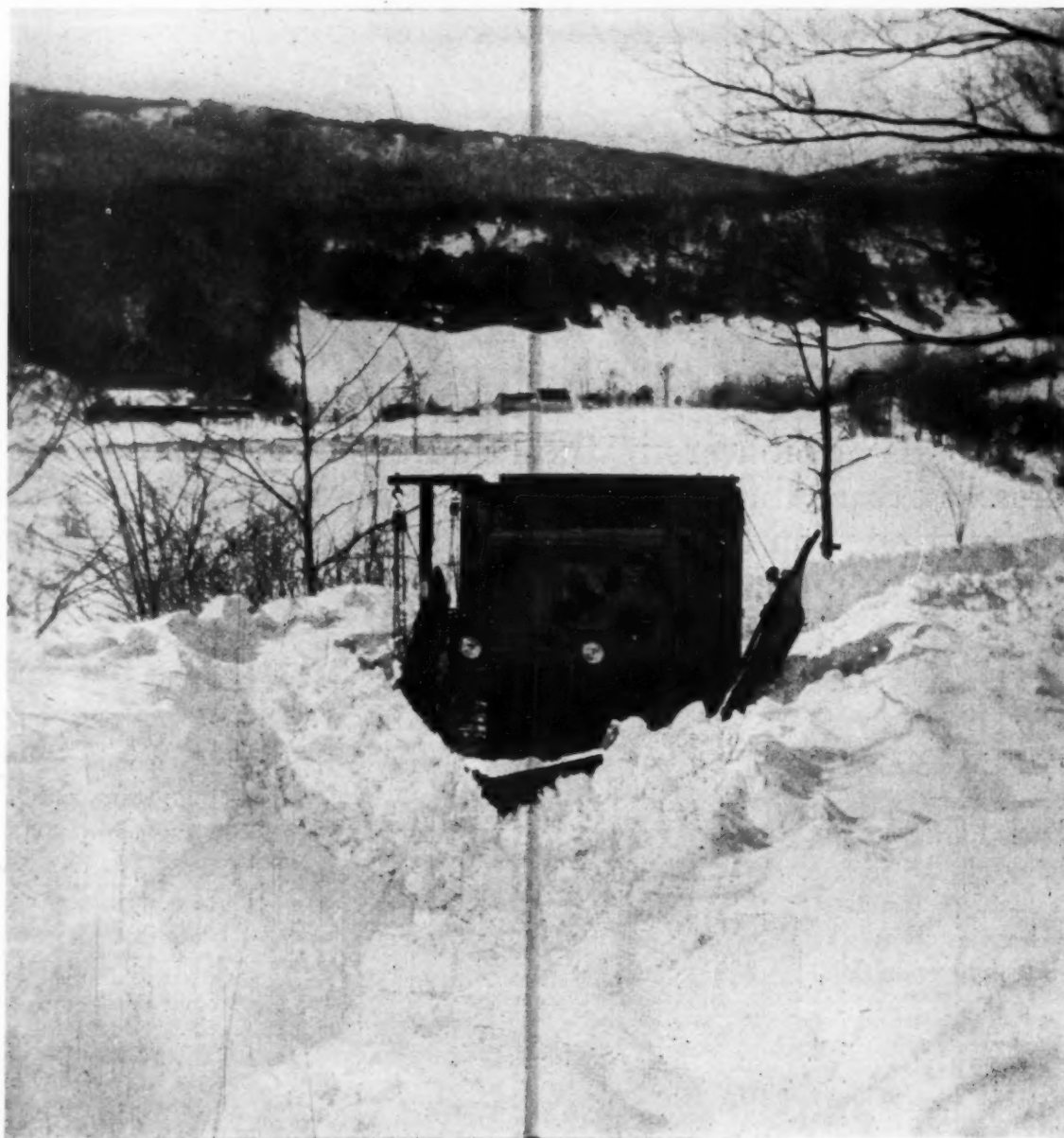
lifting jack—small and compact, it has plenty of surplus power.

Hydraulic in operation, with complete control within easy reach of the tractor driver, it is easily attached to or detached from the tractor. It is evenly balanced and so constructed that it eliminates the necessity of a two-way jack, yet permits leveling operations so essential in many states.

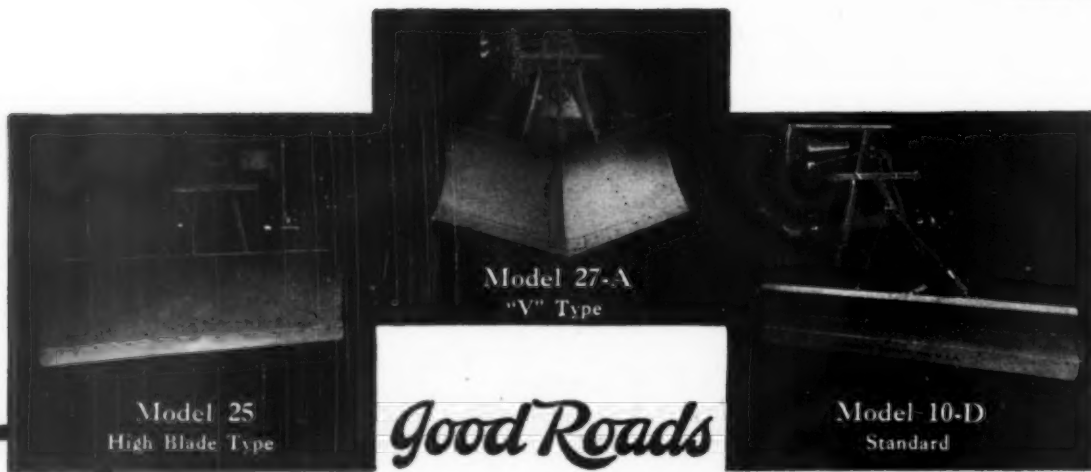


New Shovel on Street Paving Work at Benton Harbor

A Section Devoted to
SNOW REMOVAL



New developments and improvements to familiar snow-fighting equipment are delineated in the Annual Snow Removal Equipment Review on the following pages. This array of plows, loaders, power units, snow fence and other products should answer satisfactorily the maintenance engineer's query, "What shall I buy?"

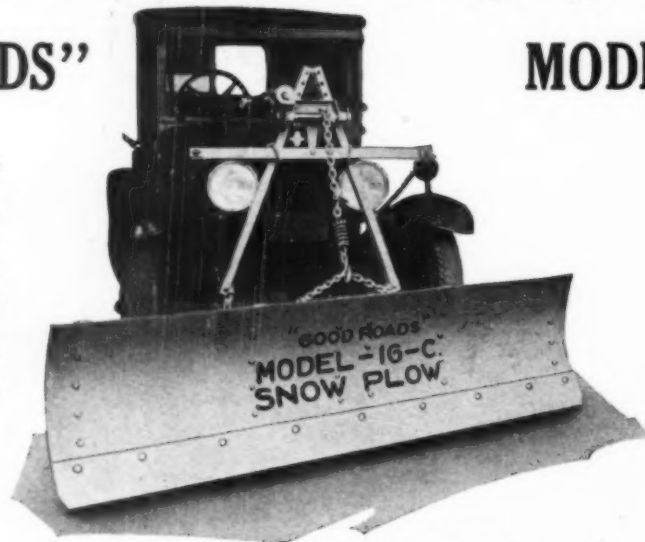


Champions

"Good Roads"...pioneers in the building of Snow Plows that are universally attachable to any standard make of Motor Truck or Bus...from one ton capacity to the heaviest built...and in various Models to meet any condition of High-Speed Snow Removal.

"GOOD ROADS"

A HIGHLY effective . . . Reversible Blade Snow Plow . . . embodying all the important features found in the heavier Plows . . . but light enough



MODEL 16-C

in weight for use with the thousands of one ton—one and one-half ton Trucks now in use . . . bringing such truck equipment into the field as efficient and effective Snow Removers.



Bring your Snow Removal Problems to
"Snow Plow Headquarters"

KENNETT SQUARE, PA.

BRANCHES AT

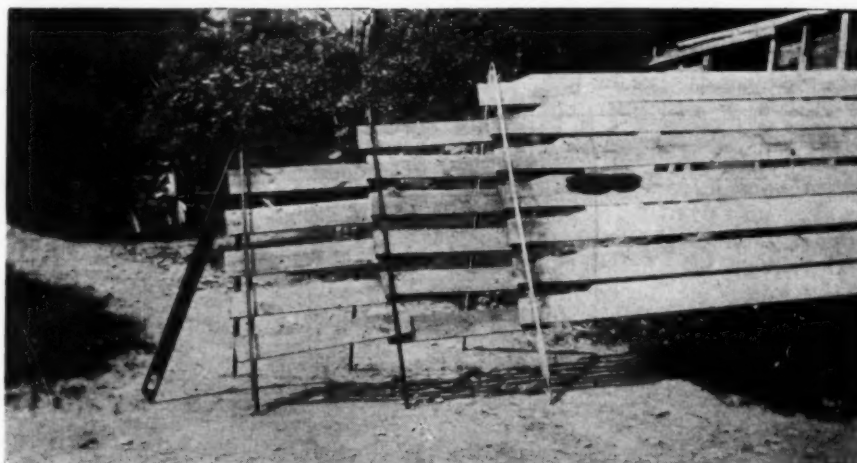
Watertown, Mass.	36 Pleasant St.	Pittsburgh, Pa.	1941 Oliver Bldg.
Portland, Ore.	3rd and Hawthorne Sts.	New York, N. Y.	50 Church St.
Chicago, Ill.	1821 Builders Bldg.	Albany, N. Y.	405 First Trust Bldg.
Philadelphia, Pa.	810 Commercial Tr. Bldg.	Buffalo, N. Y.	733 Ellicott Sq. Bldg.
	Harrisburg, Pa.		Security Trust Bldg.

The Good Roads Machinery Co. Inc.

Please mention ROADS AND STREETS—it helps.

Equipment for Snow Removal

THE varied problems of snow removal call for a variety of equipment, ranging from hand shovels to huge rotary plows, from fence for the prevention of drifting in rural districts to loaders for clearing the city pavements. This annual review, supplementing the snow-removal articles published in the September and October issues of *ROADS AND STREETS*, should furnish those responsible for winter maintenance with sufficient information to pursue their programs with the utmost efficiency and assurance of satisfaction to highway users.



View Shows End Brace of Sno-Bar as Well as Three Heights and Wider Boards in 6-In. Fence

Sno-Bar Fence Improved

The Sno-Bar fence first described in *ROADS AND STREETS* for November, 1929, has been improved in several ways. It consists of folding steel standards or posts which open to about 45 deg. and are anchored to the ground by wood anchor stakes driven diagonally through the slots at the foot of the standards. The members of the posts are slotted to retain common 1x6-in. boards which are simply slipped into the slots like bars into a bar post. The slots, being wedged at the bottom, automatically lock the boards by their own weight. A metal brace for use at the ends of sections of fence has been added this year to replace the board or pole braces formerly used. This brace is of the same Z-shape design and length as the posts and, when hooked into the top of the standard and anchored to the ground with the anchor stake, serves as both a pull and push brace, thereby eliminating one of the wood braces formerly used. It nests together with the posts for compact storage.

The advantages of Sno-Bar, as claimed by the manufacturers, are many. It is now made in three sizes, 4, 5 and 6 ft. high, to meet the requirements of those sections having severe winters as well as those more fortunately situated. Every part is light and it stores in a small and compact space. It is quickly and easily erected, will fit any contour of the roadside and is convenient to any desired length. It is being conveniently used on ledges, lawns and ice where stakes cannot conveniently be driven, by spiking to poles or timbers such as old railroad ties laid alongside the foot of the standards. It is efficient. When erected with

6-in. boards it presents 63 per cent of wind-breaking area. It is a sloping fence and is set to deflect the wind upward. Wider boards can be used as shown in the picture, which will cause the snow to drift very close to the fence. This is an advantage where the fence cannot be set well back from the highway. The 6-ft. fence is erected practically as easily as the lower ones and is claimed to stop more than two lines of common 4-ft. fence. It is durable, which, with all other advantages, makes it an economical snow fence to use.

Sno-Bar is manufactured and sold by the Geo. L. Barrus Co., Lithia, Mass.

Master Snow Plows

Los Angeles County, Calif., uses Master snow plows propelled by crawler-type tractors. These 20-ft. blades are controlled by the tractor driver. For most snow-removal op-



Master Snow Plow Clearing Road Through Big Pines Recreation Camp

erations the county usually sends two tractors equipped with Master snow plows out together. One follows the other so as to clear the entire highway for its full width.

For further information write Master Equipment Co., P. O. Box 517, Florence Branch, Los Angeles, Calif.

"Good Roads" Snow Plows

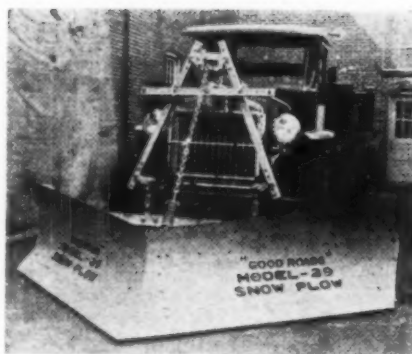
A new model V-type snow plow has been brought out by the Good Roads Machinery Co., Inc., Kennett Square, Pa. This is known as model 29. It is built for use with trucks of 3½ tons capacity and upwards. It can be used with or without the adjustable side wing attachment. Dimensions and weights of model 29 are: Approximate weights, plow complete, with adjustable side wing attachments, two-speed lifting device (regular equipment when side wings are used), and all other attachments 3,200 lb. Plow only (without side wings) with standard lifting device and regular truck fittings 1,350 lb. Plowing width, wings lowered and at maximum spread 22 ft., minimum, 15 ft. Plow only, without wings, 10 ft. Height of plow, including mould-board and cutting edge at front (nose) 24 in., at rear 30 in. Lifting height at nose 24 in., at rear 9 in. These dimensions may vary slightly, depending upon make of truck.

Several improvements have been made in the model 16-B reversible blade plow developed early in 1929 for use with light truck equipment, with capacities varying from 1 to 2

tons. Malleable iron castings have been substituted at several important points to replace forged parts, as formerly used. Ball and ball thrust bearings are used in the lifting device as in the heavier types.

Major improvements in the reversible blade type snow plow model 10-D consist of a change in the standard lifting device housing, which will project further forward, outside, and in front of the supporting legs instead of between them, as formerly. A new, and much stronger and effective clamp has been produced to replace the collar with set screw formerly used on the telescopic hand wheel shaft.

The Models 20-C and 27-A plows now are supported on three adjustable sliding shoes. One of these supports the nose of the plow, with the



Model 29 snow plow, with adjustable side wing attachments

remaining two located at either end (rear) of mouldboard. The adjustable stem housing for each being firmly secured to plow. The plow's clearance can thus be adjusted to any desired height (within limits).

The Evolution of a Snow Plow

(With apologies to Mr. Upson)

AUTHOR UNKNOWN OR MODEST

It may be that the missing link between man and his grandfather, "the monkey," will some day be located. Stranger things than that have happened. Already Lindbergh proved to be the missing link between man and a bird. Gertrude Ederle proved to be the link between man and fish. Grapefruit is the missing link between lemons and oranges.

But stranger yet is the evolution between the present day snow plow and the original snow plow. The present snow plow when mounted on one of Mr. Upson's "Earthworm" tractors or a truck is about equal to any of the above evolutions when looking back at some of the monstrosities originally built to battle the bogey commonly known as snow.

The evolution of snow plows dates back to an early date sometime since the time of Adam and Eve. We know it was since then, because, judging from the amount of clothes worn then, snow plows were not needed in those days.

Well, any way, it must have been a long time ago, although some of the present snow plow manufacturers claim to hold the basic patents. Evidently they are much older than they look.

The first plow that the writer can recall was a crude push plow built by nailing two boards together in a V-shape with two handles nailed on it extending upwards. In that case, the writer must have been the missing link between the "Earthworm" and the old time ox team, because, while yet small, he could be seen

bright and early on a winter morning furnishing the power behind that plow.

Gradually I tired of playing the missing link and one day discovered that the Old Gray Mare might be one of the proper missing links, so with creative skill and remarkable genius, designed a plow to fit the increased demand for more power with less manual labor on my part. I don't believe either of these plows was really basic in idea although both were built of wood. For a flexible rear connection I used the tugs ordinarily used, and two inverted shafts formed the frame surrounding the substitute for the "Earthworm."

In this original experiment five important ideas were used:

1. The plow was built of wood.
2. The plow was V-shaped.
3. Power was required so the horse was the "Earthworm" or a truck.
4. A frame surrounded the power.
5. The drawbar was in the rear.

Possibly I might be the Henry Ford of snow plows today had I realized what inventive genius was involved in that construction for I find three features out of the five are still in use. Maybe my failure to get those patented may prove that I am the fellow Barnum spoke about in his mind wanderings.

Now, rather than start an argument, I will concede that the frame surrounding the power and the V-shaped moldboard and the rear drawbar may have been used before then, and that my idea was not basic.

Just the same, those three features have passed the test and are still recognized as good construction in building snow plows.

Of the other two points, the next to be lost in the process of evolution was the power. The motor truck and "Earthworm" came into existence to furnish the power. Both of these are still good form today. Because of having greater power over the brute strength and horse power originally used, the "Earthworm" and truck are today depended on for more work, just as I turned to the horse for more power.

When the "Earthworm" came into its own, some ingenious inventor went a few steps farther in improving on my first plow by putting some wings on it and also some runners. These wings, as originally built, made good riding places for the spectators who always followed the plows in those days and some conveniences had to be arranged for them. This idea of furnishing them seats in the grandstand though, proved to be an unforeseen improvement, for it was found that their weight on the wings made the wings stay down and do better work. Many wonderful inventions have happened in the same way.

The "Earthworm" was so much bigger than the original power (namely, myself) that the plow became quite large and it was necessary to carry it some way and have a means of lifting the V so the "Earthworm" could turn around. After a lot of deep study by candlelight, inventive genius came to the front and arranged to lift the V and wings by chain hoists. Wonderful strides had been made and the people felt a new era had arrived.

These plows were still made of wood, were pushed from the rear, were V-shaped and had a frame around the tractor. The first tail, namely the power, had evolved. The second tail to go was the use of wood even though it had been successfully argued in many cases that wood was the only material that would scour in snow. The original V shape had changed very little during this evolution for it was argued that a knife would cut butter better than a dull spade.

It was not the "Earthworm" that caused the wooden plow to disappear and be replaced by steel, but some say it was the wood worm. That is open to dispute by anyone, but it was the next tail to be lost in the process of evolution.

About this time there must have been a lull in the steel market.

When Winter Hurls His Challenge



BE READY!

THERE is no way to evade the issue when Winter strikes! Swiftly and with little warning Winter takes control of city and countryside, paralyzing trade and traffic, threatening lives and property. There's only one way to master the situation—*be prepared with competent, adequate snow fighting equipment.*

For nearly fifteen years Cletrac Crawler Tractors have been the preferred power units for the nation's snow fighting work. Built sturdy and rugged as fine steels and sound design can make them, they are ideal for this gruelling service. They are powered for handling the heaviest types of plows and equipment. Moving along on broad, sure-gripping steel tracks they bring their full power to bear on stubborn banks and smash through seemingly impassable drifts. Many times

they have been called on to complete jobs where other tractors simply could not carry on.

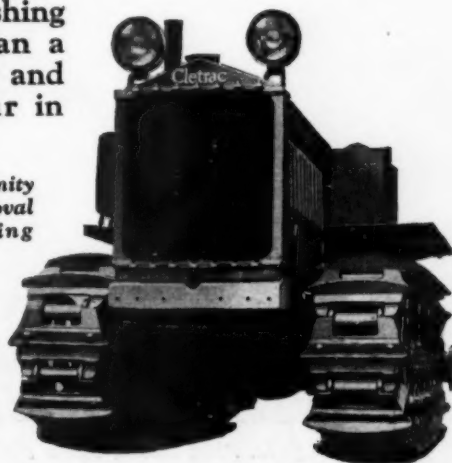
Scores of letters every winter from officials testify to Cletrac's unmatched performance in snow clearing. At Hiram, Maine, last winter a Cletrac 40 was purchased for their work. "It did not seem possible," wrote the owner, "that a tractor could plow up such hills in high gear. We have used it against frozen banks, pushing them back for more than a mile. We have timed it and made six miles an hour in heavy snow easy."

Assure yourself and your community of full control over your snow removal problems this winter by selecting Cletrac. There is a distributor near you who will gladly give you the facts—or, if you prefer, write direct for literature.



**THE CLEVELAND
TRACTOR CO.**
19320 Euclid Avenue
Cleveland, Ohio

A Complete Line of
Heavy Duty Crawler
Tractors for Use with
Standard Makes of
Snow Plows and Snow
Fighting Equipment.



Do you mention ROADS AND STREETS when writing? Please do.

Maybe Charley Schwab was looking for another outlet for steel. Anyway for some unknown reason several manufacturers started to build plows out of steel to replace the wooden plows in this process of evolution.

In building the steel plows several of my old ideas were still used, such as a frame around the power, a flexible drawbar and a rear-end push. Later I was to learn, though, that all three of these ideas belong to some one else. Manufacturers went ahead using the later additions to my original plow such as runner, wings, V-shaped rolled moldboards, etc., but they made them of steel so that was different.

At first people sure gave the manufacturers of these steel plows the razzberry. The first steel plow was built in the summer and people were sure steel would not work. They argued that the steel would get cold, the water and snow would stick to it and it would never scour. How did anyone know they were not right? It could not be tried out in the summer to prove whether right or wrong. There was one manufacturer with almost his entire fortune tied up in that snow plow and it commenced to look like he had only befriended Charley Schwab in buying that steel and wrecked himself. He did not give up though but determined to await snowfall and try it before hanging himself from its overhead scaffold.

Finally snow came and it came thick and fast. He then thought spring would be there before he could get anyone with a tractor to place enough confidence in it to let him try it out. Finally a friend who handled the "Earthworm" tractor

wanted to sell his tractor for removing snow and since he had the plow already built, he agreed to try it out. It worked. Hurray! He was acclaimed an inventor. Old theories were exploded although many people felt just like they did when the radio announcer said Tunney won. They did not believe it and neither did they believe a steel snow plow would work.

For a matter of two or three years after that, though, the favorite stunt of many salesmen who were still selling wooden plows was to ask the member of the Board of Commissioners or Selectmen to hold up their hand if they had a wooden or steel sidewalk snow shovel at home. In those days invariably they had wooden shovels and the salesman said, "Why do you use wooden shovels at home?" Only one answer, gentlemen. "It scours in snow and steel don't!" Logical! Yes and many plows were sold on that bit of strategy.

One by one the manufacturers shifted over to steel plows and those same manufacturers who had said steel would not scour had to change their minds.

Following the designing of plows which would stand up under the tremendous tasks to which they were assigned practically all manufacturers devoted their attention to means for increasing speed and efficiency of operation. Some manufacturers claimed that a sharp-nosed plow would cut into deep drifts easier than a blunt nose. Their argument was that it was easier to cut wood with a sharp knife than a dull one. More logic, but some found the sharp nose worked like a fish hook. It went in all right but it wedged the snow and

when it became stalled it was just like pulling a fish hook out of a ball of yarn.

Owing to the side-draft encountered the manufacturers also found that the blunt-nose plow was better in pushing back the side banks when widening the road. Judging from the tenacity with which some manufacturers stuck to the sharp-nose idea one might think they were all from Missouri. Finally they learned though and some even went too far the other way by making almost a square-nose plow.

Then came a plow with hydraulically-operated wing plow lifts. The manufacturer even went so far as to make it comfortable for the operators to plow snow by placing the lift levers in the cab of the tractor. That was going too far, so the competitors said. Talk about your sales resistance. That manufacturer sure had plenty. The favorite story of competing salesmen was that the oil would freeze up in cold weather. In other words they called it a summer snow plow.

There are always some people who will take a chance like Columbus did, though, and gradually these plows were introduced and demonstrated that they would work in cold weather. Then the competitors again scratched their heads and one by one they worked out hydraulic or mechanical lifts to meet this competition.

Now that snow removal has proved to be practical, one wonders what will be the next development in snow-removal equipment. During the last few years in addition to building snow-removal equipment the manufacturers have also had the task of proving that snow removal was practical. They argued that a fire department was of no value if the roads were blocked. Medical attention and skill were of no value if the doctor could not get to the patient.

On the reasons for snow removal the competitive manufacturers agreed. They only disagreed on the way it should be done and the equipment used, which was only natural. We take off our hats to them as they have done a lot in making it possible to use our cars in the winter as well as the summer.

Those men are truly snow-removal pioneers. As a result of their tireless and in some cases profitless efforts the snow-removal problem has passed through the evolution stage to a place where it now stands on its own feet as a necessity of life, comfort and convenience.



La Plant-Choate Snow Plow Breaking Through

COUNT THE COST OF THE SNOW BLOCKADE



Above: McCormick-Deering Industrial Tractors keep the tracks clear for the Evanston Railway Co., Evanston, Ill.

At right: Scraping down to the pavement—this keeps concrete in good shape.



Above: A McCormick-Deering-powered plow taking big bites out of a snow drift near Barron, Wis.

At right: One man does a lot of work with this outfit in a day.

Below: One of a fleet of five McCormick-Deering-powered snow loaders in Jersey City, N. J.



COUNT the cost of snow-blocked roads and streets in your community. Consider the loss to business, to the farm, to life, to property, and to the roads, that the snowbelt suffers every year—and you'll see why snow-removal pays. More and more miles are being kept open every winter but there is still a tremendous lot of work to be done.

In the fight against snow you need the best forces you can command. The McCormick-Deering Industrial Tractor stands at the top of the list. Its ability as a snow-fighter is well known. It is the accepted standard of power throughout the snowbelt. It is used alone and as the power heart for a variety of snow-removal equipment.

The McCormick-Deering is economical to operate—permitting you to make the most of your budget for snow-removal. It is powerfully rugged to stand the grind on the roads for days at a stretch when blizzards rage and winds drift snow on the highways. Interruptions for service are few, but when service is needed there are 115 Company-owned branches in the United States and Canada and thousands of McCormick-Deering dealers ready to serve you fast.

This is the time to lay plans for snow-removal. Get in touch with the nearest branch or a McCormick-Deering distributor or dealer for power and equipment. Ask them to demonstrate the McCormick-Deering Industrial Tractor for you. Write us for catalogs.

INTERNATIONAL HARVESTER COMPANY

606 So. Michigan Ave. of America
(Incorporated)

Chicago, Illinois

MCCORMICK-DEERING INDUSTRIAL TRACTORS

Detroit Snow and Street Brushes

The maintenance of uninterrupted winter traffic through the use of Detroit snow and street brushes, manufactured by the Detroit Harvester Co., Detroit, Mich., in the removal of snow again emphasizes the practical and economical value of this company's product when employed for street, road and alley cleaning of snow and dirt.

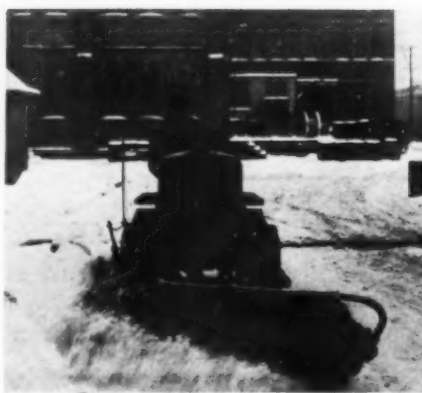
Detroit snow and street brushes are universally accepted for the important tasks which they perform. Many municipalities, counties and states have standardized on Detroit brushes for this work, not only for their efficiency, but for the economy effected, reliability and service.

One of the first items on municipal budgets is the allowance which provides for clean streets. Not so long ago this was a job which was done entirely by hand, and while the "white-wing" system held certain advantages, it was both costly and slow. The Detroit brush will materially reduce this expenditure as it can be utilized from the moment the snowfall starts, whether day or night, keeping the pavement clear at all times. It sweeps a clean path 5½ ft. in width, with forward speeds of 3 to 8 m.p.h., depending upon the working conditions, and will handle 6 to 8 in. of snow with ease when attached to the tractor or truck. Other equally important uses for which this equipment can be employed with great saving are sweeping municipal garages, airports, and ice-skating rinks.

The tractor or truck can be equipped with a water tank for laying dust in front of the broom as the brush hood frame is so constructed that the water is fed evenly by gravity the full width of the brush, keeping the dust down to a minimum. The Detroit snow and street brush weighs less than 700 lb. and can be installed or detached easily by any mechanic. The brushes are heavily filled with long split bamboo, insuring excellent wearing qualities under severe working conditions.

Owing to the increased demand for Detroit snow and street brushes, they are now available for the Allis-Chalmers model U, Caterpillar models 10 and 15, Case industrial, Cletrac 20, Fordson, Ford truck, McCormick-Deering 10-20 industrial and Whitehead & Kales industrial tug.

In addition to the Detroit brushes, the Detroit Harvester Co. manufactures a full line of tractor mower attachments, which have gained popu-



Sweeping Snow with Detroit Snow Brush

larity among highway departments throughout the entire country for keeping the shoulders of the highways free of obnoxious weeds which set up a serious hazard through the winter months in the snow sections by allowing the snow to accumulate and fill the highways.

Sargent Improves Plows

Sargent model 1931 snow plows, which are manufactured by the Maine Steel Products Co., South Portland, Me., follow the design saving curves of the Sargent V. The adaptable Sargent of 1931 offers ten practical engineering improvements as follows: free-lift nose, high-lift wing, auto-lift push arm, selective wing action, plow-mounted wings, super-suction cutter bar, dual-purpose mold boards, four-point spring suspension, one-man power cab control (hydraulic), one-man manual cab control (hydraulic).

Full details of each of these improvements will be sent on request. But briefly they will make snow plowing faster, cheaper and more comfortable to the operator.



Sargent Plow Mounted on Trackson-McCormick-Deering Tractor Unit

Austin-Western Snow-Removal Theory

It was soon discovered, after general snow removal was given serious attention, that it was an engineering problem, one requiring close cooperation between the engineers of state, county and municipal departments and the designing engineers of equipment manufacturers.

Proper equipment and a trained personnel is the answer to any snow fighting problem, and since snow removal is nothing more or less than winter road maintenance, if the equipment used to accomplish it coordinates with summer maintenance equipment, year-around economical maintenance will result.

Since trucks of 2-ton size and larger are being used extensively for haulage purposes in the construction and maintenance of roads, it is logical that they should be made, if possible, an important part of snow-removal equipment. It was soon discovered that they were easily adaptable to the snow-removal program, since their weight, strength, speed, power, traction and general design accommodated the push-type plow so effectively.

Western truck snow plows are of two general designs, the V and moldboard types. Of the latter there are different heights available. Both the V-type and the moldboard type are especially designed for speed, which is the predominating factor in the efficient and quick dispatch of snow.

Western truck snow plows have many important practical and economical advantages, namely:

They are convertible, both fitting the same framework mounted on the truck, and the substitution of one

unobstructed **VISION**



**IS
ABSOLUTELY
ESSENTIAL
IN A
ROTARY
SNOW
REMOVER**

S N O G O

SNOGO is the only rotary that gives the operator full vision at all times.

• • • • •

Not only throws the snow to either side with the wind—but throws it from the **WINDWARD SIDE OF THE MACHINE.**

• • • • •

The snow stream never crosses the operator's line of vision.

SEND FOR THE COMPLETE SNOGO CATALOG

KLAUER MFG. CO. DUBUQUE, IOWA

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Austin Motor Grader Equipped for Snow Removal

blade for another is but a few minutes' work.

2. The moldboard type plows are reversible, so that the snow may be thrown in either direction to take advantage of drift and drifting.

3. Either type of plow is sufficiently inexpensive to be well within the financial reach of the smallest municipality or township.

4. Western plows do not require special motive power, since they are readily attachable to any type of truck.

5. Both V and moldboard types have a special and correct curvature to dispatch rapidly accumulating banks of snow to the side of the highway.

6. The special curvature permits the plow proper suction in keeping it down to a working level, and the mushroom runners prevent the plow from digging in.

7. The construction of the plows and the method of attachment to the trucks eliminate all side draft, which factor is indispensable in snow-removal operations on sidehills, municipal streets and public highways.

8. Western plow attachments are of the underslung type because this method of attachment relieves the front axle from undue strain.

Further, the point of attachment is beneath the truck where the greatest strength and weight are found to withstand the strain and severe shocks of plowing, and the sidewise thrust of snow. Western plows, both V and moldboard types, are constructed so strong that they are enabled to withstand the terrific power of two trucks used in tandem.

Another important piece of summer maintenance equipment that lends itself admirably to snow removal is the motor grader, such as the Austin Dual Drive, with

its abundant power and traction. Innumerable cities and counties throughout the vast snow belt have found, during the past three years, that Austin motor graders equipped with Austin V-type plows and special snow blades are capable of doing surprising work.

Motor graders with snow-removal attachments are capable of handling 3 ft. of snow without any difficulty. Because of this, many counties having a 3-ft. average depth of snow are accomplishing their winter maintenance with that equipment alone. Motor graders are very effective during the early winter season and during the winter break-up in pushing slush and ice off the highways. By this means, expensive surfaces are quickly dried and saved from the destructive washing of running water, and the formation of ruts due to deeply penetrated and soggy surfaces.

Motor graders are, again, available to maintain highways during the

early winter, at which time there is frequent and intermittent thawing and freezing. While the V-type plow ahead of the grader is pushing the snow from the highway, the maintenance blade is smoothing the surface and eradicating ruts which probably have formed. Motor graders, likewise, are given regular beats to patrol during the winter season in areas of lesser drifting, while the heavier truck equipment is operated in areas of more severe conditions.

Austin-Western snow-removal equipment, consisting of truck and motor-grader attachments, does, therefore, solve the economical phase of the problems, since those attachments are designed for the two equipments which comprise the important tools of summer maintenance. A special snow-plow bulletin is available, covering the various equipment of the Austin-Western Road Machinery Co., Chicago, Ill.

Russell Broom Sweeps Snow

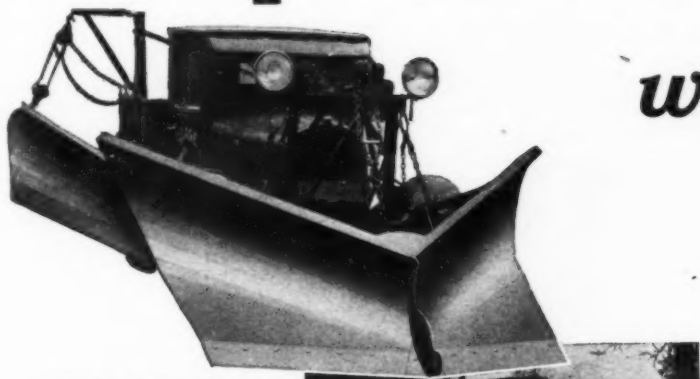
The Russell snow sweeper is mounted on a 5-ton motor truck. The broom is independently driven by a 60-hp. motor, mounted over the rear axle and leaving the truck motor fully free for its own work of propelling the apparatus. All movements of the broom are simple and entirely controlled from a comfortable weatherproof cab. The broom is properly counterbalanced and automatically compensates for any unevenness in the pavements. An adjustable hood or apron prevents the snow or dirt from being scattered promiscuously when the machine is in operation in city or town. On open road work it may be raised to



Russell Rotary Snow Broom

Keep Traffic Moving

with **FRINK**
SNO-PLOWS



FRINK FEATURES

Plow will not wedge or buckle in high drifts.

Higher speed. Pushes one-third easier.

Inside control.

Quickly attached to any standard truck.

Readily adjustable to scrape road clean or leave several inches of snow as conditions demand.

Easily detached. Does not interfere with use of truck for other purposes.

No side thrust even when using only one side of plow.

Lifts clear for driving from one job to another.

Bevels the banks.



Insure open highways and uninterrupted traffic by writing **TODAY** for Sno-Plow Catalog No. 10

The heavy snows will soon be here—hundreds of state, county and municipal officials have assured the public of safe, clean highways by purchasing Frink Sno-Plows. These speedy snow fighters will clear snow blocked roads at 20 to 35 miles per hour. Their scientific design enables them to penetrate the deepest drifts, throwing the snow as far as the fence line. Beveling wings trim off the banks and spread the snow to eliminate the formation of drifts.

Prepare now for the heavy snows—equip your trucks with Frinks.

Davenport Locomotive & Manufacturing Corp.

Davenport, Iowa

Licensed Manufacturers of Frink Sno-Plows for Illinois, Wisconsin and States West of the Mississippi



"V" Truck Snow Plow



"V" Tractor Snow Plow



Baker Bulldozer



Baker Rotary Scraper

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Baker Snow Plows for Trucks and Tractors

Over 40 models in both "V" and blade types.

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$\frac{3}{4}$, 1 and $1\frac{1}{2}$ cu. yd. capacities for tractors.

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4 sizes—13 to 40 cu. ft. capacities.

Baker Hydraulic Bulldozers and Backfillers

For Caterpillar and Monarch Tractors.

These catalogues are ready for you:

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THE BAKER MANUFACTURING CO.

506 Stanford Ave.

Springfield, Ill.



Baker Maney Scrapers

Do you mention **ROADS AND STREETS** when writing? Please do.

enable the broom to throw the snow amply clear of the road.

All power transmission is through shafting, chain and bevel-gear drives, amply sized and well supported, assuring long life and low maintenance. The broom is of finest quality rattan to withstand long, hard wear. It is 34 to 36 in. in diameter and cuts a clean swath 9 ft. wide. This sweeper is made by the Russell Snow Plow Co., Ridgway, Penn.

Barber-Greene Snow Loader

A pioneer in the field of mechanical snow handling, the crawler-mounted snow loader of the Barber-Greene Co., Aurora, Ill., is built for high-capacity handling.

A pair of sturdy cleated crawlers gives the machine power and traction on the slipperiest surfaces. The feeding end of the Barber-Greene snow loader is a huge plow, designed to minimize bunching and arching of snow when handled in great quantities, which receives the snow on to a 32-in. rubber belt mounted with cross cleats. The huge plow maw and the speed of the wide, cleated belt have enabled the machine to make such records as clearing a city block in Madison, Wis., in 15 minutes that would have taken an hour for a gang of 40 men and 10 teams. In Schenectady, N. Y., one of these machines, the manufacturer states, loaded trucks at the rate of a 7-ton

truck in 45 seconds, making it possible for only 6 trucks to do the work that before had tied up 20. In Springfield, Mass., a snow loader filled a 5-ton truck in 20 seconds, they claim, and in Chicago an 8-yd. truck was loaded in 20 seconds.

To eliminate danger from striking manhole covers or other obstructions, the plow on the loader is built so that it may be adjusted from the operator's platform to pass over them.

The Barber-Greene snow loader discharges directly to the rear, and is equipped with baffle plates which help direct the discharge, making careful spotting of trucks unnecessary. When side discharge is required a special snow trailer—a conveyor mounted on rubber-tired wheels and powered by an 8-hp. gasoline engine—is used.

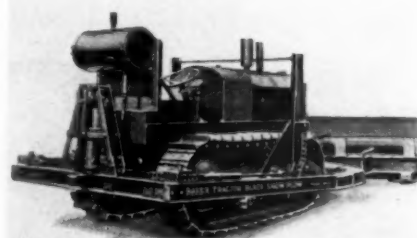
In the city of Newark, N. J., two Barber-Greene snow loaders, working continuously 20 hours a day for 10 days, according to the manufacturer, dug the city out of one the hardest snowstorms in its history with a reduction in loading costs of 57 per cent, in loading time of 66 2/3 per cent and an actual saving in dollars of \$6,508.

So that the machine need not remain idle in summer time, it has been designed so that the snow loader boom may be interchanged with a Barber-Greene bucket loader boom on the same chassis. The Worcester Consolidated Street Railway Co., of Worcester, Mass., uses this arrangement, utilizing the machine for sum-

mer maintenance work. The cities of Milwaukee, Providence, New Bedford and Worcester are among the municipalities which get summer work out of their snow loaders.

Baker Develops New Features

The Baker Mfg. Co., Springfield, Ill., is building this season a line of snow plows for motor trucks and tractors with many new and exceptional features.



Baker Push Plow with Hydraulic Lifting Device

The Baker tripping-blade snow plows will be offered with a new type of runner. The lifting devices on all truck snow plows will be equipped with new cut-gear enclosed-type gear boxes. Besides the standard V-type truck plows, there are several models of V-type speed plows, in addition to one-way trip blade speed plows for all standard trucks, including Ford AA, Chevrolet 1½-ton and International 1½-ton. In tractor plows there is a complete line of both blade and V-type plows for Monarch tractors and the larger sizes of Caterpillar tractors with both hydraulic and manual lifts.

It has been over 22 years since Baker made the first horse-drawn snow plows.

Trackson for Power on Plow

Tractor-powered snow plows are extensively used for winter maintenance of city streets and country highways alike, and today many counties, townships and cities as well as state highway departments, employ whole fleets of such units for their snow removal operations.

A very effective and economical combination, it is claimed, is the Trackson McCormick-Deering crawler tractor and Sargent plow, shown in the illustration. The versatility of this equipment is an important factor, for it has power to handle the heavy snowfalls and speed for the



Barber-Greene Snow Loader at Work. Note the Vehicle License Plate on the Machine

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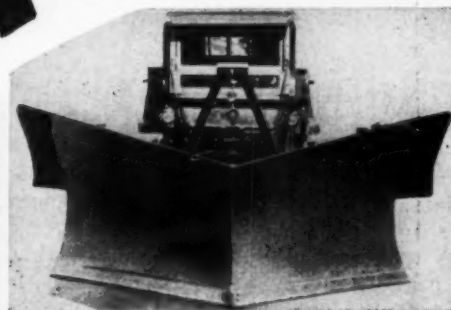
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CLEAR ROADS in a

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BIG BUSTER V SNOW PLOW

Root Big Buster V Plow is designed for large trucks to replace slow moving tractors in heavy snow. Ninety per cent arc welded. Will stand punishment of two large trucks working tandem if needed. Special angle adjustment gives tendency to "dig-in", rather than climb over. Plow raised or lowered by small hydraulic hand pump located within easy reach of driver. This same pump controls the action of the extension wings, raising either wing to any position and folding or extending them to any angle. This operation is very important as wings can be used extended to full width, when meeting any vehicle either wing can be quickly folded without stopping truck. Can be operated as one-man unit.

Root Giant Spring Scrapers—Hydraulic—Reversible for maintaining earth, gravel or cinder highways will cut your maintenance costs in half and the surface of your road will be in better condition.

Manufactured and Sold by

The Root Spring Scraper Co.
Kalamazoo, Michigan, U. S. A.

Full details and prices furnished on request





Trackson-McCormick-Deering Snow Plow Unit Breaking Through Deep Drift

light ones. The Trackson crawlers provide sure footing, plenty of traction for work in soft, loose snow or on icy grades, and increased power. The Sargent plow has adjustable wings which may be raised for the first trip through deep drifts, or lowered for widening the road on successive trips.

The cost of snow removal with Trackson crawler tractors is low, for they are economical in consumption of fuel and oil and require little attention. What few repairs or adjustments may be necessary from time to time are simple and easily made. Also, the one-man operation of these machines is an important factor because it enables a single man to handle the entire operation of clearing the highways, doing many times as much work in a day as horse-drawn plows or scrapers, or men with shovels, can accomplish.

Another important advantage of Tracksons is their year-round usefulness. When the last snow has melted in the spring and the slush and ice have been removed from the highways, the plow can be removed from the crawler tractor and the latter is ready to be used with various types of graders, scrapers, shovels, etc., and for general utility purposes.

In the New England states alone, the manufacturer states, there are several hundred Trackson crawler tractors doing year-around highway duty. Some of these are employed by contractors, but the majority are owned by the state, county or local highway departments. As soon as the first flurry of snow appears in the sky, they are equipped with Sargent plows and from then on, through the long winter months, they patrol the highways almost constantly, assuring their respective

communities of protection to health, lives, and property. Again in the spring, summer and fall they are kept busy building roads and repairing and maintaining old ones.

FWD Snow-Removal Equipment

It used to be snow plowing. Today it is snow removal, because snow is cleared entirely off the highway, off the shoulders of the highway, out where the spring meltings leave the waters in the roadside ditches and not on the highway to form dangerous ice coats during the night freezes. Snow removal is possible because adequate machinery has been designed to do the work.

Among the power units used in winter highway maintenance are the trucks of the Four Wheel Drive Co., Clintonville, Wis.—the line that drives through all four wheels and

includes the distinctive feature of the center differential, the device that compensates for the differences of rotation between the front and the rear wheel axle shafts, as the vehicle negotiates corners or rough terrain. By locking the center differential—the lever for doing so is located on the dash in the cab—the entire transmission assembly, from the front to rear axle shafts, becomes one rigid unit. The importance of this will be seen later under the discussion of traction.

Snow-removal equipment is built in many forms, including the single blade, the V-shape and the rotary types. FWD trucks are so designed that any snow plow or snow shovel can be mounted. The flexibility of the FWD line is an important feature. The FWD engine develops no more power than is developed by engines of competing makes, but it distributes that power to the front as well as the rear wheels, thereby, it is claimed, utilizing a higher ratio of power to that developed. That feature is of extreme importance in regions where snow drifts are deep. For rotary plow operation, an auxiliary motor may be installed on the rear end of the frame, through which the truck may be propelled at the required speed, leaving the front motor free to operate the rotors. Truck speed and rotor speed may be correlated properly by using this assembly.

All four wheels of FWD models are live ones, thus giving four points instead of two for traction contact. In the event the wheels of either axle find no traction, the other axle set will pull them to solid footing. This is where the principle of the center differential lock, as explained above, becomes effective. Traction in FWD



Rear View of FWD Showing Auxiliary Motor. Scene Taken Near Ishpeming, Mich.

ECONOMY PLUS



BLIZZARD BUSTER Snow Fence costs you less per pound than you usually pay for corrugated culvert pipe.

It is guaranteed for 30 years.

It will, in all probability, last for 50 to 60 or possibly 75 years.

It will save its cost every ten years in the savings due to setting up and taking down over costs to set up and dismantle the cheap lath fence.

It will save you the entire cost of the cheap lath fence every three to five years.

It will save you over 33 1/3% per year over the costs of any other snow fence you can use.

Officials of Stark County, N. Dak., claim it will more than save them its cost every ten years. An official of Kalamazoo County, Michigan, where the State Penitentiary makes lath fence and sells it to the counties at a cost of 4 1/2¢ per foot, says that they could not afford to use the cheap lath fence even if it was given to them free because BLIZZARD BUSTER saves them so much that the cost of using picket fence would lose the County money.

With such testimony are you not ready to adopt it, too?

Yours for a better way,

Just address NICO-494

Northfield Iron Co., Northfield, Minn., U. S. A.

For City or Airport use "Blizzard Buster" has no equal. Painted Highway yellow for Airports at reasonable extra cost.

BIG RED SNOW FENCE

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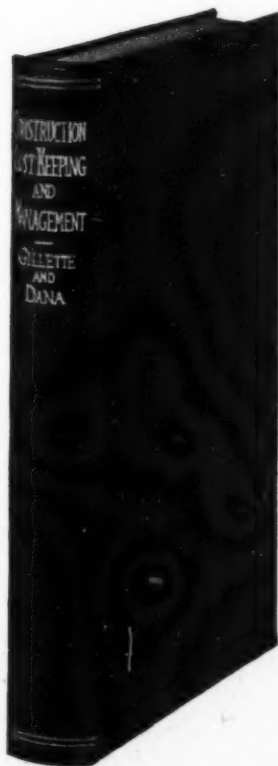
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Successful contractors and engineers must add to their technical knowledge and experience sound business practice. You know failures that were due to lack of this important ability to manage and keep costs for assured profits. We wish every member of the profession could reap the benefit of the principles plainly set forth in this practical guide. We offer the opportunity to read it through without a cent of expense. This will permit you to realize its vital importance to your business. If you do not, simply send it back. The coupon below is your opportunity. Fill in and mail at once.

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By Halbert P. Gillette and Richard T. Dana

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trucks is positive and certain at all times, because of the availability of this lock. Under no conditions must snow-removal equipment ever become stalled.

Snow left in banks on the highway is a menace. No plow can clean the highway on one swath; back must go the unit further out to remove the snow. One of the tendencies of the plow, especially that of the single-blade and the V-types, is to create side thrust, producing an objectionable "snake's trail." FWD trucks as power units obviate all this and hold the plow rigidly to line, the manufacturer states. This is because the pulling stresses, they claim, are distributed through the entire frame instead of being concentrated at the rear ends as in rear-driven trucks.

Walter Snow Fighters

Walter Snow Fence, made by the Walter Motor Truck Co., Long Island City, N. Y., have been specially designed and developed for snow-displacement service. They have proved remarkably effective under all snow conditions. The four-point positive drive insures adequate traction for heavy snows and for slippery road conditions. Powerful six-cylinder motors up to 130 hp., in connection with the special 10-to-1 range transmission provides a proper plowing speed for all operating conditions. The unique Walter front axle permits of easy steering and positive control for the direction of power. Walter Snow Fighters hold the road even when plowing snow entirely on one side and with large side wings.

The accompanying view shows the Walter Snow Fighter equipped with an offset V-plow which has been found remarkably effective for the handling of deep snows on highways.

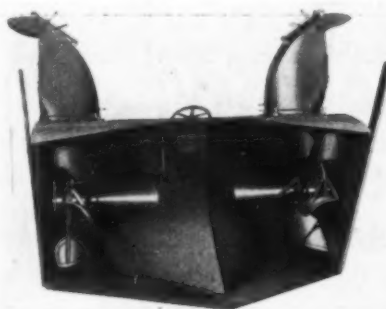
The center-pressure scraper blade is very effective for city service or other conditions where there is heavy traffic, as this blade scrapes right down to clean all-packed snow or

ice, preventing the formation of dangerous ice ruts.

Walter Snow Fighters are equipped with dump bodies, road oilers and standard types of bodies, making them a useful unit all year round.

Snow King Improves Chutes

The Rotary Snow Plow Co., Minneapolis, Minn., manufacturers of the Snow King lateral-type rotary plow and North Star speed plow,



New Snow King with Revolving Chutes

announce a new type of the Snow King to be operated with trucks having four-wheel drive and a second power unit mounted on the truck chassis to propel the truck, leaving the front motor free to operate the rotors whenever the load becomes too heavy for the regular truck motor. The combination has been developed to meet the demand for speed equipment.

The plow follows the lines of tractor models of the Snow King in use during the past seven years. The chief difference is in details of rotors and chutes; the moldboard is somewhat different with ends enclosed. Outstanding features are full revolving chutes and power-operated hoist, whereby snow can be thrown in any direction, not merely to right or left. An adjustable hood permits the stream of snow to be deflected close by. The power-operated hoist is a great convenience. It is of

mechanical type, driven by the crankshaft of the truck motor. The hoist is part of the transmission of the plow and is contained in the same case with the transmission parts. A positive acting clutch and friction type brake are set on a cross shaft on each side of a gear on which is mounted the worm, this being cut from the stock of the pinion shaft. Control is from the cab by means of a lever. When the limit of lift is reached the clutch is disengaged automatically.

The motor of the second power unit is usually the same as that of the truck, although any motor rated at 50 hp. and upward can be employed. The great advantage is sufficient power in deep snow, whereby the rotors can be kept up to speed; also a great variety of speeds, ranging from $\frac{1}{2}$ to 30 m.p.h. and even more. The plow is carried at high speed of truck when not working. The use of two motors permits of employing a truck of a size practicable for other jobs and yet able to operate a large rotary plow.

An additional feature is a hitch by which the North Star speed plow can be attached to the same truck as employed with the Snow King; the switch can be made in 30 minutes. In this manner the truck can be used with both plows and in any depth of snow.

Joy Improves Loader

The Joy snow loader is manufactured by the Joy Mfg. Co., Franklin, Pa., who are also builders of mechanical coal loaders.

The improved Joy snow loader is designed to load snow exclusively, and its construction is such as to overcome difficulties experienced with other snow-loading devices.

The improved Joy snow loader is a self-propelled, four-wheel, conveyor-type loader. The conveyor is fed by the Joy patented gathering arms, which sweep and dig the snow in a horizontal plane into the conveyor. The loader is operated by one man from a driver's seat on the left side of the machine.

The loader is driven by a four-cylinder Hercules engine. Power is transmitted from the engine clutch through a flexible coupling to the transmission. Two clutches are provided, one for the conveyor and the other to drive the loader. These clutches may be operated independently of each other. With the engine running at 1,200 r.p.m., the loader has six forward speeds (from 70 to 688 ft. per minute) and two reverse



Walter Snow Fighter Ready to Work

ROADS AND STREETS

Design, Construction, Maintenance
and Traffic Control

August, 1928

H.P. Gillette

Vol. LXVIII, No. 8

Hercules Engines



Chicago Pneumatic Standardizes on Hercules

Unfailing performance, low upkeep costs, and ability to run with little attention, together with endurance, have established Hercules Engines as standard power in this internationally known make of compressors.

Utmost reliability in widely different uses has earned Hercules Engines an enviable reputation. In road building and general contracting equipment, farm implements, marine equipment, railroad power equipment, commercial transportation units, and oil field equipment, Hercules Engines can be depended on to furnish unfailing power to serve both operating and economy needs.

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General Office: Canton, Ohio, U.S.A. West Coast Branch: Los Angeles, Cal.

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For

Highways

JANUARY—the Annual ROAD SHOW Number

*Is Your Space
Reserved?*

The Magazine that Heads the List in Service to the Highway Field.

Editorial and advertising pages devoted exclusively to roads and streets. Greatly increased reader interest and advertiser service since featuring of County and Township Roads.

Primary and Secondary Fields completely covered. January issue will contain detailed descriptions and illustrations of Road Show Exhibits. Statistics of 1930 Construction and Outline of Work for 1931.

Convention Issue will be distributed at the Road Show in St. Louis. Be sure your message reaches delegates in this number.

THE CONVENTION ISSUE
CIRCLES THE GLOBE

*[Forms Close]
[December 20th]*

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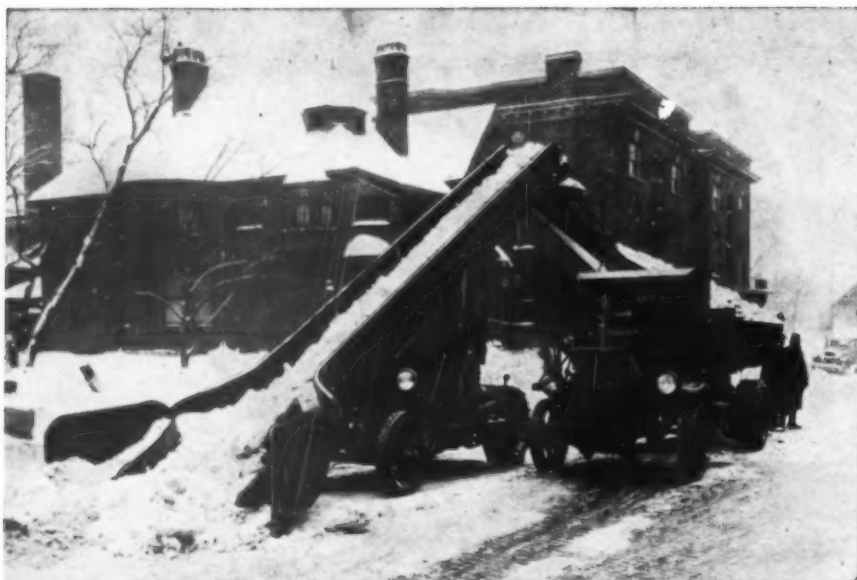
San Francisco

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Yes—we would like you to mention **ROADS AND STREETS**.



Improved Joy Snow Loader Cleaning Street

speeds (95.2 and 208 ft. per minute). With the engine running at 1,800 r.p.m., a maximum traveling speed of 12 m.p.h. is attained.

The conveyor consists of two steel roller chains carrying cross-flights spaced 13 in. apart. The width of the conveyor trough is 29 in. and the height of the sideboard is 16 in. The capacity is from 10 to 20 cu. yd. per minute, depending on the character of the snow or ice to be loaded, the manufacturers state. The gathering arms at the feeding end are of manganese steel and will clear a path 7 ft. 8 in. wide. The conveyor clutch is adjusted so that if the arms should encounter immovable articles, the clutch will slip back without stalling the engine, permitting the driver to back up a few inches and relieve the arms. The elevation of the conveyor is controlled by two hydraulic jacks. The conveyor can be held in any position between horizontal and a slope of 30 deg.

The Joy loader has a 120-in. wheelbase. Its overall width is 8 ft. 9 in. and its overall length is 34 ft. 7 in. Its overall height when loading is 14 ft. 6 in. and the height under the swinging chute is 7 ft. 2 in. The swinging chute has a 6-ft. radius. The weight of the loader fully equipped is 16,700 lb.

A number of the improved Joy snow loaders are now operated by the city of New York.

Cletrac Pushes Plow Through

Snow plows require power. Cletracs are an acceptable form of power for both blade and rotary

plows. The accompanying picture shows a Cletrac made by the Cleveland Tractor Co., Cleveland, O., with Snow King rotary plow breaking



Cletrac Powers a Rotary Plow

through some deep drifts in northern Michigan last winter. In some places these drifts collected to a depth of 14 ft. The outfit shown herewith is



Warco Grader Clearing City Street

owned and used by the Michigan State Highway Department.

Warco Graders Handle Light Snow

Ordinarily, a light snowfall of 2 or 3 in. offers little or no impediment to moving traffic, and usually requires no special removal efforts. However, if the first snowfall becomes partially melted and churned up by traffic, and the weather suddenly turns cold, as often happens, so that the half-melted snow is rapidly turned into ice with sharp and irregular edges, and then another 2 or 3 in. of snow falls, filling the crevices and irregularities in the ice, a real traffic obstruction arises. Such a situation prevailed on many highways and city streets during the last winter season.

In one city such a situation was handled by pressing into use two Warco one-man center-control graders, equipped with Warco rear-type crawlers. These graders are made by the W. A. Riddell Co., Bucyrus, O. In the accompanying picture one of these machines is shown blading the semi-frozen snow and ice to the curbs, forming a smooth passageway for motor traffic. Where the ice was unusually heavy and solid, the independent scarifier operating ahead of the blade effectively ripped up the ice so that it could be easily handled by the blade. Ample traction was furnished through the rear-type crawlers, for they utilize the full power of the tractor for effective tractive effort.

A V-type snow plow can also be readily attached to the front of any Warco power grader for use in han-

ding snow up to 12 or so in. in depth.

Warco power graders with independent scarifier or snow plow attachments are procurable in both center and rear-control models, and with these attachments offer year-around service in keeping roads and streets smooth and open to traffic.

Preventing Snow Blockades

According to reports compiled by the American Automobile Association, 160,000 miles of roads will be kept snow-free during the coming winter. This warfare against the elements will be carried on through the county and state highway departments in 36 states of the union. If this program should not be carried out and increased each year the effect it would have on business ventures in the form of losses could hardly be estimated.

Never before has the use of snow fence played such a prominent part in snow-blockade prevention as it will this winter, E. S. Gaynor, of the E. S. Gaynor Lumber Co., Sioux City, Iowa, informs us. The highway commissions and even the railroads have found it far more simple to prevent the snow from covering their roads than to try to effect its removal after it has fallen. Numerous highway officials give the following reasons for their preference for snow fence: (1) Low first cost, (2) Practically no repairs, (3) No fuel necessary as is the case in snow removal methods and (4) No operators.

Besides all these features it keeps the roads open continuously and prevents even the slightest delay to the traffic.

The E. S. Gaynor Lumber Co., will operate snow-fence factories at Fergus Falls, Minn.; Aberdeen, S. D.; Kingsley, Iowa; Sioux City, Iowa, and other points in the Northwest this year. They explain that

they have spent years in perfecting their machinery and are selling a quality product in this line.

Their fence consists of carefully selected $\frac{1}{2} \times 1\frac{1}{2}$ -in. by 4-ft. clear fence pickets which are tightly woven between five double strands of $12\frac{1}{2}$ -gauge copper-bearing wire and painted with a red oxide mineral paint. The fence is usually put up in 50-ft. rolls. Many highway officials prefer to have their fence painted with a black wood preserving oil which prolongs the life of the fence somewhat.

Gettelman Designs Special Attachments

Gettelman Hi-Speed snow plows are specially designed for Ford and Chevrolet trucks. The plow, which is of the blade type, cuts a path 8 ft.



Gettelman Snow Plow Attached to Chevrolet Truck

wide. The blade is 34 in. high and made of $\frac{1}{8}$ -in. steel. The cutting edge is of high-carbon steel and reversible. Structural steel angles reinforce the curvature of the blade and the cutting edge. The push arms are made of seamless steel tubing, affording maximum strength with minimum weight. Winch worm and gear are machine cut. Tension-type springs are easily adjusted to meet plowing conditions. Castings are electric steel, annealed and machined to jigs. Drop forgings are used where maximum strength is required. There is but one position for the Gettelman Chevrolet plow blade.

This has been determined by careful tests.

The trip action of the blade protects the plow and truck from road obstruction. The blade is pivoted so it can tip forward. The tension springs and the counterbalancing effect of the snow immediately bring the blade back to scraping position.

The offset blade throws the pressure line to the rear of the steering knuckle of the front wheel. This action tends to keep the truck nosed toward the discharging snow instead of away from it. The offset blade also permits the truck wheels to remain on the pavement and still clear the snow beyond the edge of the concrete.

The Gettelman Hi-Speed snow plow can be installed, by following simple instructions, in a few hours. Once the installation is made, very little time is required to attach or detach the plow. This plow is made by the Heil Co., Milwaukee, Wis.

Acme Grader-Plow

The power grader-snow plow of the Acme Road Machinery Co., Frankfort, N. Y., is so contracted that the unit may be installed directly on present industrial tractors. It is claimed that it does not push the snow ahead, but rather, it slices underneath, rolling and curling it aside.

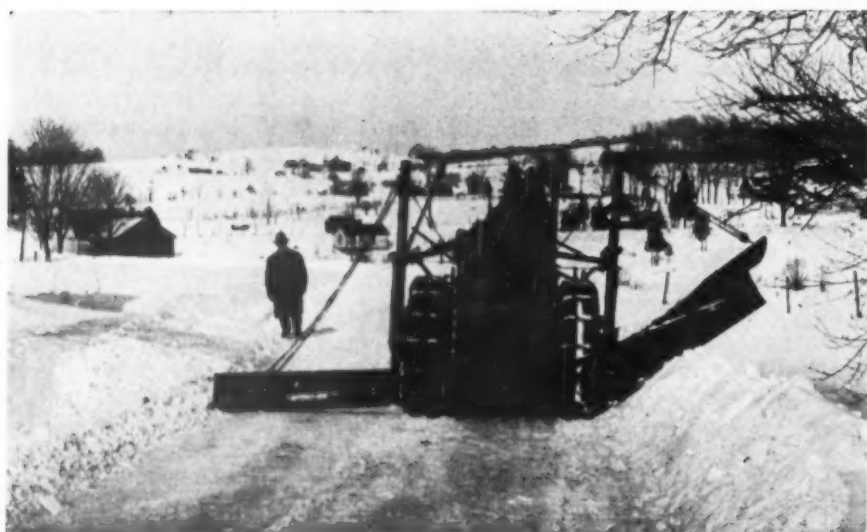
Most important of the four snow-removal blades, according to the manufacturer, is the underneath type of grading blade which may be adjusted to the fraction of an inch by simple hand or power operation. This grading blade operates in the same manner as it does when used for power grading in other seasons; it shaves and curls the first 12 in. of snow into the side wings for banking. Its 8-ft. moldboard with a reversible cutting edge gives an Acme power grader for year-around use in highway maintenance.

It is located under the machine between the front and rear wheels. This gives a more rigid control than in any other position, lends itself more easily to any unevenness of the surface and permits the operator perfect visibility of its action at all times. It is also adjustable to an angle of 49 deg., with the line of direction, and either end of the blade may be independently raised or lowered.

The actual snow-plow blades consist of two laterally adjustable side wings and the forward V-plow. This concave plow which gives the snow its rolling motion has a depth of 4



Gaynor Big-Drift Snow Fence at Work



Acme Power Grader-Snow Plow at Work

ft. It is so attached that all heavier snow beneath the upper layers is handled by the sturdy grading blade beneath the machine. This plow, with the grader blade alone, will clear a highway 8 ft. wide.

Root Big Buster V-Plow Improved

Root Big Buster V-plows have full hydraulic operation. The hydraulic pressure may be generated by a small hand-operated hydraulic pump operated by the truck driver or by mechanical power. The power is taken at the take-off on the transmission.

The hand-operated pump will raise the plow about $\frac{1}{2}$ -in. to each stroke, and will raise either wing $2\frac{1}{2}$ in. to each stroke or will extend either wing rapidly. This action is very rapid when the power pump is used. The plow is heavy enough to stand the power of two large trucks in any depth of snow, yet it is easily controlled by the truck driver from his position at the steering wheel.

Last year this plow was raised by hydraulic pressure. Each wing was also raised in this manner. Now the new and most important feature is the extending to any angle and folding of each wing either together or separately with the truck moving at full speed.

Many maintenance departments have long realized the need of this wing action, as a highway can be cleared to a wide width, yet either wing can be quickly folded to allow vehicles to pass or in passing any obstruction. Each separate operation can be had by one pump by merely opening a common globe valve that directs the pressure to the desired point.

A full line of V or blade plows, hydraulically operated, is also manufactured by the Root Spring Scraper



Root Big Buster V-Plow

Co. Kalamazoo, Mich., for any size truck from 2 tons up.



Clearing Away the Windrow with a Nelson

A blade or V plow can also be furnished for a Ford, Chevrolet or International 6-speed special truck.

Nelson Snow Loader

In cities and larger towns, snow removal requires more than just breaking a path through the drifts with a plow. For towns are places where vehicles not only go, but also stop—stop at the curb for a minute or an hour or until they get a ticket; stop on the varied and necessary businesses that take them to town. If the gutter is piled up with snow they must stop in the traffic lane. Then the truck behind either hits them or gouges its way through the pile in the opposite gutter. Traffic becomes a nightmare in chaos. That snow simply has to be taken away, whether in trucks, sleds or wheelbarrows, and it costs real money to shovel it up into trucks. It's slow work, expensive and back-breaking.

For this work in Philadelphia down the street comes a big brown machine, its front end scraping the pavement, and behind it follows a big truck. Both stop, and the truck, heaped high with snow pulls out into the roadway to drop its burden over the bridge into the Schuylkill river. Before that truck is around the corner another has taken its place and the march continues. A man strolling leisurely down the street would just about keep abreast of the work.

That machine is the Nelson snow loader manufactured by the N. P. Nelson Iron Works, Passaic, N. J.

One hundred and seven Nelsons fight New York City snows. Some fifty more are scattered through the surrounding suburban towns, opening the great traffic ways that lead into the big city.

Mattson Snow Fence

Mattson combination wood and wire fencing for snow control is made from heavy pickets which are woven between strands of Bessemer steel wire, heavily galvanized to give maximum protection from rust. Every foot of fencing has picket tops perfectly even, as the fence is woven on high-speed automatic machines with reversible twists between each picket, preventing the picket from being pushed up or down in the cables.

The pickets are 4 ft. 2 in. apart with 5 cables of No. 12½ galvanized wire. The fence is put up in rolls of 50 and 100 lin. ft. The shipping weight is about 360 lb. per 100-ft. roll.

This snow fence is made by the Mattson Wire & Mfg. Co., Joliet, Ill.

Fox Snow Loader

The Fox snow loader, which is built primarily for snow and is not a converted sand loader, will travel at from 4 m.p.h. in 6 to 7 ft. of packed snow, to 12 m.p.h. in light snow, escalating the snow about 9 ft. from the side of the road. While the machine was built for city work, it has demonstrated in the last two winters that it will open up highways as well as tractors and rotary plows. The Fox loader can go through any snow, it is claimed.

The Fox loader is able to travel fast on its own power from the garage to the snow field, it is able to load snow quickly, it can load either to the right or left into trucks and if desired it can throw the snow clear of the road and into fields.

The Fox snow loader is made by



This Fox Loader Was Called as Emergency Equipment from the Northern Part of One of Our Eastern States to the Southern Part to Fight Snow Drifts

the Fox Rotary Snow Broom Co., New York, N. Y.

Theory of Picket Snow Fence

By JOHN W. DENNING

Vice-President, Illinois Wire & Mfg. Co., Joliet, Ill.

In spite of the fact that snow fence has been on the market for something like seven years, there is still considerable misconception with reference to the proper method of erection. The efficiency of snow fence is largely dependent on the proper erection, and the Illinois Wire & Mfg. Co., Joliet, Ill., has, this year, started a campaign to educate all users of snow fence as to the proper methods of installing. The instructions we give below are the result of exhaustive tests, both by us and by several prominent state highway departments.

It has been a great surprise to many who are not familiar with the action of snow fence, when they find that the snow drift is formed on the side of the fence towards the road. This, of course, is entirely logical, when the action of snow fence is

analyzed. It is a well recognized fact that the amount of foreign matter which air can carry in suspension is a function of the velocity of the air. The higher the velocity, the more and heavier the material it will transport.

The greatest drifting of snow usually occurs after the snow has fallen, rather than during the storm, although this is somewhat dependent on whether blizzard conditions prevail. Whichever the case may be, the snow particles which do the drifting are usually confined to a level of not more than 6 in. to 1 ft. above the surface of the ground, or hard packed snow. Since it is the velocity of the wind which causes the snow to drift, if this velocity can be reduced the amount of snow carried in the air is automatically reduced. In other words, part of the snow goes out of suspension.

Snow fence effectively reduces the velocity of the air traveling close to the ground, by breaking it up into small, eddying streams; and these eddies, caused by the wind sweeping under and through the fence, cause the particles of snow to drop out and form in a drift. The shape of the drift is dependent on three factors, the initial velocity of the wind, the height the bottom of the fence is above the surface and the size and spacing of the pickets.

If the bottom of the snow fence is placed from 6 in. to 1 ft. above the surface of the ground, the best action is obtained. The wind sweeping under the fence serves to prevent the fence becoming choked with snow and yet this position gives the largest and shortest drift behind the fence. Often where the condition prevails that the bottom of the fence is clear for the wind to sweep under, the drift will be built up to a considerable height above the top of the fence. Therefore, it is advisable, whenever possible, to keep the bottom of the fence clear from snow, by raising it from time to time, as



Showing Proper Installation of Picket Snow Fence

the depth of snow builds up. For this reason posts at least 1 ft. or more longer than the height of the fence should be used to allow for raising several times during the snow season.

Since the bulk of drifting snow travels close to the surface, the wind, as it sweeps up over the drift, free of snow, is again imparted with its original velocity by the action of the wind above the level of the fence. This action tends to sweep the roadway clear, and gives a secondary action which is nearly as important as the drift-arresting action of the snow fence.

The distance which snow fence should be erected back to the windward side of the road is dependent on the velocity of prevailing winds. Other conditions being equal, the length of the drift formed will depend on the velocity of the wind and some experience is necessary in determining this distance. It, roughly, lies between 50 and 150 ft. There are a number of common mistakes in erection which destroy the effectiveness of snow fence and which are easily rectified. When erecting snow fence to protect a certain stretch of road, it is important that no gaps be left in the fence, as this will quickly cause a heavy drift to form across the road, thus defeating the purpose of the fence.

Often a board or rail fence borders the road, or the field fence may be clogged with brush, which conditions also largely nullify the effect of snow fence, by causing a secondary drift to form in the roadway itself. Wherever drifting conditions are serious, the field fence should be kept clear, so it will offer no obstruction to the wind, and board or rail fences should be removed.

Eureka Sidewalk Plow

Eureka snow-removal equipment of the W. M. Toy & Co., Sidney, O., for the season of 1930-31 embraces a full line of horse-drawn, all-steel plows for the purpose of cleaning side-walks, roads, gutters and drives in cemeteries and parks.

The Eureka sidewalk plow is being used in more than 1,500 cities, towns and villages throughout the United States and Canada. It is made in three sizes and has been found to be very economical and efficient. There are Eureka sidewalk snow plows in operation today that have been used for the past 16 years. These plows are still rendering satisfactory service and have never required repair.

In addition to the line of Eureka sidewalk snow plows, there is a new tool known as the Eureka township plow. This is a heavy, rugged, horse-drawn snow plow for the purpose of breaking township roads. The tool weighs 1,200 lbs. The maximum wing spread is 16 ft. and the minimum wing spread of the plow is 9 ft. The Eureka township plow is very easily pulled on four cast-steel runners. Swinging or skidding is eliminated by a special ice runner attachment. The township snow plow is flexible enough to adapt itself to most conditions.

Clark Develops Snow Plow and Loader

A new snow plow built by the Clark Tractor Co., Battle Creek, Mich., which is being offered generally on the market this season, has an 82-in. blade which cleans a path 74 in. wide. The blade is adjustable, always under the operator's control and has a cutting edge of special hardened alloy steel to take the wear. The plow assembly is supported by heavy springs mounted to absorb road shocks and in lowered position the blade rides on two steel buttons which prevent the edge of the blade striking slight irregularities in the pavement.

The plow is built on the sturdy Clarktor chassis. The Clarktor is an industrial tractor driven by gas power. In summer the plow assembly may be easily removed and a 72-in. rotary broom substituted. At any time the Clarktor may be used as a general-purpose tractor.



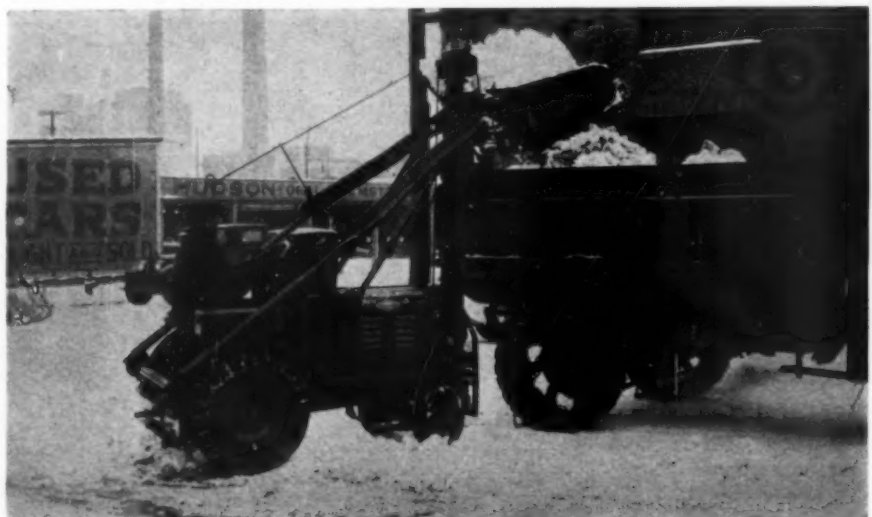
Eureka One-Horse Snow Plow

Among new equipment for loading snow into trucks is the Clarktor power shovel. This is permanently built on the Clarktor chassis. Improved hydraulic cylinders enable the operator to pick up and hold the load at any desired point. Bucket clearances are raised, 7 ft. 5 in.; dumped, 6 ft. 5 in. Municipalities, park boards, contractors, industrial corporations and railways will find this power scoop of value on many kinds of work besides snow removal. It will handle fast and economically any loose, liquid material such as sand, gravel, bulk cement, soft coal, ashes and fertilizer.

Blizzard-Buster Fence

Blizzard-Buster is a permanent or portable pressed-steel snow fence manufactured by the Northfield Iron Co., Northfield, Minn.

The posts are painted steel angles, 2 by 1½ by 6 ft. The boards are 6 in. wide, are of 16-gauge pressed metal and are 8 ft. 5½ in. long. They are galvanized. When erected the fence is 4 to 4½ ft. high. It shunts wind downward, making a rolling whirlpool of wind which deposits the snow.



Clarktor Power Shovel Loading Snow

Hand Tools for Snow Removal

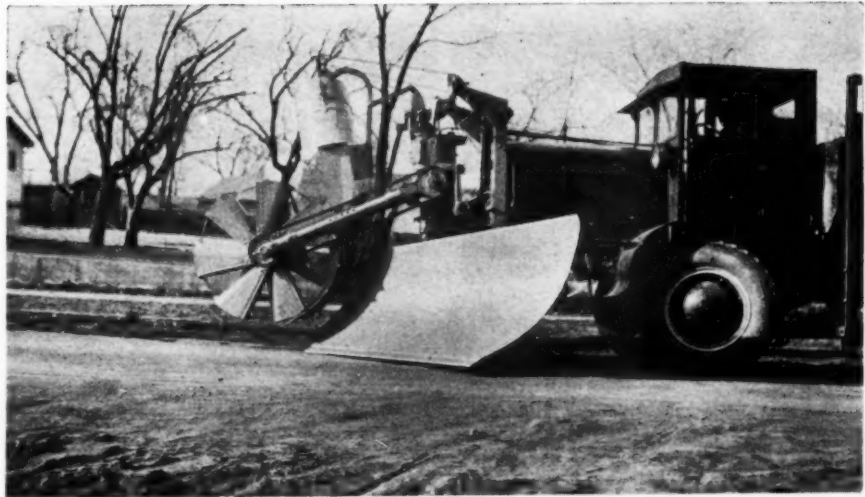
The Oliver Ames snow shovels are light and strong with handles securely fastened to the blades and constructed to handle the load with very little effort. They are furnished in two types of construction—riveted back and hollow back—each with long handles or D-type handles.

The long handles have flat sides, to prevent turning in the hand, and the D-type handles are equipped with serviceable pressed-steel tops having wood grips. They are manufactured by the Ames Shovel & Tool Co., Boston, Mass.

Frink Plows

When attached to a truck of the proper size, any of the models of Frink Sno-Plows will efficiently remove a depth of snow equal to the nose height of the plow and will spread the snow at the sides of the road. Standard makes of motor trucks are able to maintain a speed of 15 to 35 m.p.h. with the proper size of Frink plow attached. This permits following the accepted practice of patrolling the roads during the storm and removing the snow as fast as it falls.

When the Frink plow is raised with the lifting device for traveling from one job to another, the entire weight of the plow is carried above the truck springs. Frink plows and leveling wings are so attached that there is no unsprung weight. The patented heel adjustment permits the adjustment of the height of the cutting edge above the road surface, without the use of tools of any kind—a feature which is especially ap-



New Rightway V-Plow and Rotary Shovel

preciated by the operator in cold, disagreeable weather.

These snow plows are made by the C. H. Frink Mfg. Co., Clayton, Thousand Islands, N. Y.

Rightway Announces V-Plow

The rotary snow shovel for trucks manufactured by The Rightway Corp., of Chicago, Ill., will soon commence its third successful snow-fighting season.

The Rightway shovel is operated on fast trucks as auxiliary equipment to V-type moldboard plows. The rotor is driven on the outer end of a boom which may be swung from side to side and raised or lowered by controls in the cab. In all ordinary depths of snow, the moldboard plow alone is used, and the shovel is carried high above the V where it does not interfere.

Aside from the advantages of high speed and auxiliary use, it does not depend upon traction for its performance in opening roads, and the depth of cut taken by the rotor may always be regulated within the capacity of the truck's power supply. Adequate traction is usually difficult to secure in snow, and the weight and consistency of the material vary to such an extent that a prescribed depth of cut for the rotor could not be equally efficient at all times. When the snow is not frozen or too wet, a full cut, the capacity of the rotor, may be taken, and, where the snow is extremely heavy or frozen, the rotor cut is reduced proportionately, but there is no such thing as getting stuck. After the road has been opened, the rotor may be swung to one side against a bracing bracket, and is used to throw away the banks which have been rolled up by the moldboard plow. In this position the rotor over-extends the truck wheels 4 ft., and it is therefore not necessary to get the truck over onto soft shoulders.

The Rightway Corp. also announces that it will place on the market this year a new V-type moldboard plow for trucks, which was thoroughly proved last year in Colorado, California and northern Michigan. This plow is of sturdy construction, very efficient in either light or heavy snow and incorporates many novel features of design, such as a blade on the prow to split frozen snow formations, a double shear mounting for the blades, a fast and very easily operated hoist and large, adjustable shoes with removable wear plates.

This plow was primarily designed for use in combination with the rotary shovel but, as the shovel and plow work independently, the com-



Frink Sno-Plow Mounted on Mack Truck

pany has decided to offer the plow for truck use generally. The plow is pushed from the front end of the truck frame through flanged rollers which resist the side thrust or wing pressure, and it is said that the curvature of the moldboards is such that, operated at speed, the plow will throw the snow well over to the side, whereas in heavy going there is no tendency whatever for the material to pile up ahead, or for the blade to climb up on the frozen snow next the road surface.

New Wisconsin Special Snow Plow

The new Wisconsin plow, built for any 10-ton tractor, with or without wings, has been thoroughly tested under the severest possible conditions. The overhead lifting device is actuated by hydraulic means.



New Wisconsin Special Showing One Wing Lowered and One Raised

A shoe-and-roller construction carries the weight of the plow over bare spots on the road. The side wings may be used in either a lowered or raised position.

Following are specifications for the model 200, which is manufactured by the Otto Biefeld Co., Wauwatertown, Wis.:

Length overall	19 ft. 6 in.
Width of cutting edge	12 ft. 0 in.
Width at top of moldboard	14 ft. 0 in.
Height overall	11 ft. 6 in.
Height at front of plow	4 ft. 9 in.
Height of outer edge of plow	6 ft. 6 in.
Width with wings fully spread	22 ft. 6 in.
Length of wing	6 ft. 6 in.
Width of wing, front end	3 ft. 0 in.
Width of wing, rear end	4 ft. 0 in.
Weight, approximate	10,000 lb.

Motor Grader Equipped with Plow

Adams motor graders are equipped with plows for handling snow on county roads. In the accompanying picture an Adams motor grader owned by Edmunds County, S. D., equipped with an Adams plow is pushing its way through a drift on one of the county's roads. This is



Adam Motor Grader with Snow Plow Attachment

part of the county winter maintenance work.

These units are manufactured by the J. D. Adams Co., Indianapolis, Ind.

Snow Removal with Blair Hydraulic Diggers

The Blair hydraulic digger, high-lift model, equipped with 54-in., 1-yd. bucket, is claimed to be an exceptionally efficient and economical unit for snow-removal work. Mounted on either a Fordson, McCormick-Deering, model U Allis-Chalmers or Case tractor equipped with rubber-tired wheels, or on a crawler, the unit is mobile, fast in its loading ability, and quickly driven under its own power from one location to another.

One-man-operated, it raises its load nearly 8 ft. and will dump snow or other materials into any make of truck whose sideboards are not higher than 8 ft. from the ground. This high-lift machine has a dumping clearance of 6 ft. 6 in. The manufacturer claims that it will load from 25 to 50 cu. yd. of snow per hour, depending on conditions. It



Blair Hydraulic Digger for Removing Snow

will do this work day after day with ease and a minimum of attention.

It can be furnished with an extra smaller bucket, of 1/3-yd. capacity, which is instantly interchangeable with the snow bucket so that the

digger may be used for digging and loading heavier materials. In short, this unit is a two-purpose machine which can be used in winter for snow removal and in summer for other work.

The Blair hydraulic digger is made by the W. M. Blair Mfg. Co., Chicago, Ill.

Link-Belt Loader for Snow Removal

When drifts are pushed back along curbs of city streets they must be removed. In the accompanying picture a Link-Belt Grizzly crawler loader is shown loading trucks on Parkway between 16th St. and 17th



Loading Trucks with Link-Belt Loader

St. in Philadelphia, Pa., Using one man to operate the loader and two men cleaning up, this machine loads a 5-ton truck in a little over a minute.

Rowe Snow Fence

The Rowe Can't-Drift fencing of the Rowe Mfg. Co., Galesburg, Ill., is made in 4-ft. height from 1/2x1 1/2-in. selected pickets woven securely between five double strands of heavily-galvanized wire. Pickets are spaced about 2 in. apart. Wires are tightly twisted between pickets and the twist is reversed between each two pickets. This weave holds pickets securely so they cannot possibly drop out or be loosened. In weaving, the fence is stretched tightly so that it will not stretch and sag after erecting.

Rowe Can't-Drift fence is furnished either painted or unpainted, in 50-ft. and 100-ft. rolls.

Distributor News

Canadian Company to Manufacture American Line of Mixers

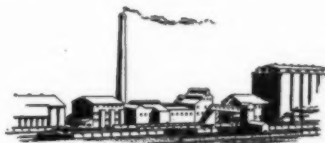
According to recent reports an agreement has been entered into between the Construction Machinery Company of Waterloo, Ia., and L. and P. Manufacturing Company, Limited, of Niagara Falls, Ontario, whereby Wonder tilting concrete mixers and Marsh-Capron Master drum type mixers for Canadian distribution will now be manufactured in the plant of the last named concern. It is said that production will start immediately of the smaller sizes of both lines and that as quickly as consistent larger sizes will follow. An adequate stock of all sizes will be available at Niagara Falls for the Canadian trade at all times.

Facilities of the L. and P. Manufacturing are said to be exceeding well adapted for the manufacture and servicing of this equipment, which will include service for Wonder and Marsh-Capron mixers now in use in Canada. Distribution of the mixers will remain in the hands of Bournival and Company, Montreal; McCurdy Supply Company, Winnipeg; Willard Equipment Company, Vancouver, and other distributors who have formerly handled this line.

F. H. Fowler, president of the Construction Machinery Company, will be a director of the L. and P. Manufacturing Company, according to report, and will personally aid in the production and sale of the equipment, which represents one of the largest and most modern lines of concrete mixers.

Regional Sales Directors for Victor Engines

Regional sales districts have been created by the Diesel engines sales department of the Power Manufacturing Company of Marion, Ohio (a subsidiary of The Osgood Company), with a representative from the home office in charge of each district



in order to render the greatest aid possible to the sales organization, in the sale of Victor engines.

The following district representatives have been appointed: Northern Region, L. R. Johnson, headquarters at Marion, Ohio; Southern Region, H. C. Stuart, 1716 Faxon Avenue, Memphis, Tenn.; Southwestern Region, Cuvie Carey, 113 Murray Street, Dallas, Tex.; Western Region, B. H. Rice, headquarters at Marion, Ohio; Pacific Region, Arthur F. King Company, 111 Sutter Street, San Francisco, Calif.

Link-Belt Prepares for Future Business

Mr. Alfred Kauffmann, president of the Link-Belt, stated recently when interviewed: "Now, during the slack production period, is the time to perfect manufacturing processes and to prepare for future business. We believe in practicing what we preach."

In accordance with the policy expressed above a contract has just been closed for a powdered coal system entailing an expenditure of \$125,000, for the Indianapolis foundry of this company. This improvement follows closely upon the completion of a new factory at Toronto, and the complete new plant for the Pacific Division at San Francisco.

A building to house the new coal system and alterations in the plant are a part of the improvements planned for at Indianapolis, where Link-Belt chains for elevating and conveying are made. It is said that the system will modernize the process of firing the melting and annealing furnaces and the heating of the boilers.

Prominent Engineer Retires

Announcement has been issued by the Robert W. Hunt Company of the retirement of John J. Cone as president of this company. Mr. Cone has been a member of this firm of well known engineers since its organization in 1888.

C. B. Nolte, formerly vice-president and general manager, has been elected president and general manager of the company with headquarters at the general office, Chicago. J. C. Ogden, a director and eastern manager of the company, has been elected vice-president, with headquarters in New York City.

Caterpillar Holds Second Equipment Show and Field Demonstration

The second annual field demonstration and equipment show recently held by the Caterpillar Company for their distributors, sales organization and manufacturers whose equipment is powered by Caterpillar tractors, brought forth the cheerful news that, "Caterpillar tractor business is good and its future promises better."

Forty manufacturers scattered from coast to coast exhibited and demonstrated their latest models for the 60 district representatives of the Caterpillar company who assembled from all sections of the United States.

Among the manufacturers coming from the far west were Killefer and Master from Los Angeles, Ateco from Oakland, and Willamette-Ersted from Portland. Comments indicated that possibly the most startling advances in equipment since the last show were the winches and booms for handling pipe line. Exhibitors interested in this particular line included Allsteel Products Company of Wichita; Master Equipment Company, Los Angeles; Willamette-Ersted, Portland; and W-K-M Company, Houston. The power augurs for boring pole holes as developed



C. Spears (left) "talks roads" to the Stewart Brothers, three Australian visitors on their way to the International Road Congress.



President C. S. Liu (center), "one of present day China's first ten men outside of the Military Regime," asking some leading questions about equipment.

by Hi-Way Trailer and Buda companies also came in for marked attention.

Of course, the special features of the Caterpillar tractors themselves received special attention from the attending crowds.

One of the most interested of the distinguished visitors was C. S. Liu, president of the China Northern Corporation, Tsin-Tsin and Piepen, China. Mr. Liu studied carefully both road and farm equipment which might be taken back to his country to help in its future building and agricultural programs. One group of foreign visitors who stopped at the show to spend a day was that of the Stewart Brothers, leading contractors of Australia, who were enroute to Washington, D. C., to attend the International Road Congress. Prof. Emery Voros of the University of Budapest, Hungary, who is in this country studying engineering, was another interested visitor, and Caterpillar dealers from Chile and British Honduras were also in attendance.

The manner in which the exhibit and demonstration was handled indicated most careful planning on the part of the men responsible for its success. There were five main divisions of activities. Construction and maintenance was directed by A. E. Loder, general supervisor of construction sales, assisted by J. C. Williamson, district representative. Logging came under the direction of J. H. Howell, assisted by W. K. Cox. Dirt moving, also directed by A. E. Loder, with the assistance of J. C. Williamson. Industry, directed by O. E. Andreen, with H. L. Wagner as assistant, and Agriculture, directed by L. J. Fletcher, assisted by W. A. Harper.

The entire construction demonstration was divided into 24 units, six units being assigned for study on two separate days, and the remaining twelve units to be covered in two half days. Each group had a leader who was responsible for his group during the period of instruction and demonstration. In this way questions were answered and the fullest information given the individual groups. Groups

were then transferred from one leader to another, which permitted covering the entire demonstration systematically and without confusion. Luncheon was served each day on the field, with time out in the afternoon for such refreshments as "hot-dogs."

Each division of the exhibit was handled in the same systematic manner with all groups under their especially assigned leaders kept as nearly as possible the same size.

New Name and Increased Facilities for Shovel Manufacturer

Through the efforts of H. B. Ross, president of The Ross Carrier Company, and the Chamber of Commerce of the city of Benton Harbor, Mich., announcement is made of the removal of the Detroit Power Shovel Company to that city and the adoption of Michigan Power Shovel Company as the new name for the organization.

Among the advantages to the manufacturer in making the move is the securing of greatly increased manufacturing facilities whereby the entire product, with the exception of the power plant, can be manufactured under one roof. The new plant is said to be ideally equipped from every standpoint for the type of machinery to be manufactured and production was started with the completion of the new arrangements, and deliveries are now being made.

Newly elected officers of the Michigan Power Shovel Company are: H. B. Ross (president of the Ross Carrier Company), chairman of the board; W. E. Bernhard, president and chief engineer; D. H. Millard, vice-president and sales manager; Don C. Abbott, secretary and treasurer. Directors: H. E. Wynne (vice-president Reed Foundry and Machine Company); D. H. Ross, of Benton Harbor, and A. Abbott of Detroit.

Herbert H. Dow

Dr. Herbert H. Dow, President of the Dow Chemical Company, Midland, Michigan, died suddenly on Wednesday, October 15th. Dr. Dow was generally recognized as one of the five foremost chemists in the country, and was recently nominated for the Chemical Markets medal by Henry Ford. The honorary degree of Doctor of Engineering was conferred upon him by the Case School of Applied Science in 1924 and by the University of Michigan in 1929.

The Perkin Medal in chemistry for 1930 was awarded to him early this year. This is the highest award given industrial chemists, and is awarded annually for the most notable work in industrial chemistry.

The phenomenal growth of the chemical manufacturing company that bears his name has been due primarily to Dr. Dow's insatiable desire for new developments. Aside from his own untiring efforts he always made it a matter of policy to encourage and support the research and experimental work that has been responsible for so many new developments in the chemical industry.

Sales Personnel Changes in Wickwire Spencer Steel

A. A. Wilmut, who has been a member of the New York Sales Department of the Wickwire Spencer Steel Company for the past five years has been made assistant sales manager in charge of structural products at the Chicago office, 208 South La Salle Street, according to recent announcement.

G. L. Crawford, who has been a member of the sales staff at Chicago for the structural products during the past four years has been transferred to the office at Tulsa, Oklahoma, where he has been made assistant sales manager in charge of structural products. The Tulsa office is located at 1304 The Philtower.

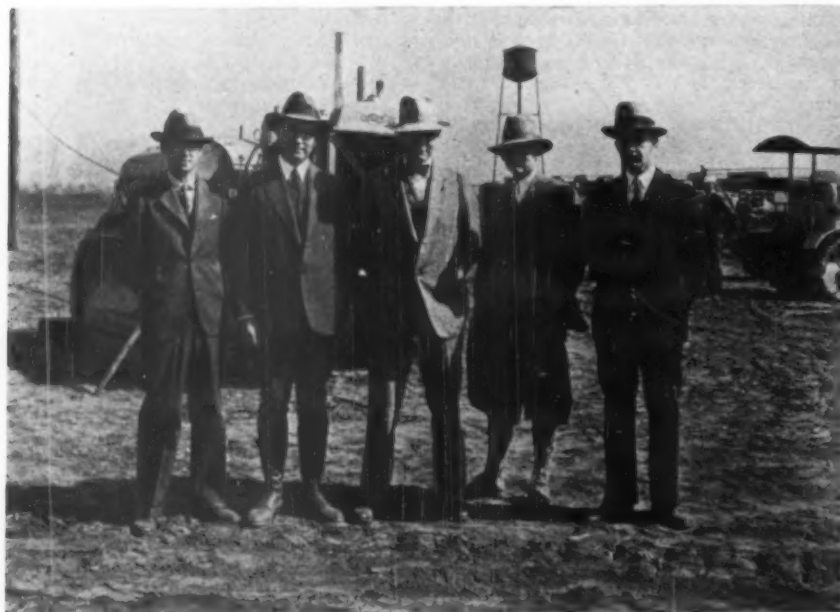
Two New Distributors Appointed by Hercules

The Hercules Motors Corporation of Canton, Ohio, announces the appointment of Hedge & Mattheis Company, and Cyril J. Burke as new distributors for Hercules engines, power units and spare parts.

In the New England States—the Hedge & Mattheis Company with headquarters at 285 Dorchester Ave., Boston, Massachusetts, will carry a representative line of Hercules products in Boston and will also make distribution out of their branches in Springfield and Worcester in Massachusetts—as well as out of Portland, Maine, and Providence, Rhode Island.

At his headquarters, 401 Great Lakes Terminal Building, Detroit, Michigan—Cyril J. Burke carries a complete stock of service parts for Hercules engines—and displays several models of the engines and units—on which prompt deliveries can be made.

The Hercules Motor Corporation of Canton, Ohio, manufacturers of heavy-duty engines, announce a change in the address of the Hercules European representatives. Hereafter the headquarters of the Automotive Products Company, sole distributors of Hercules Engines and Power Units for Great Britain and Continental Europe, exclusive of U. S. S. R., will be located at Brock House, Langham St., London, W.1., England.



They Managed the Show

Left to right: O. E. Andreen, A. E. Loder, L. J. Fletcher, T. R. Farley and H. H. Sunderlin. These are the men who were responsible for the successful planning and carrying out of the Caterpillar Equipment Show recently held in Peoria, Illinois, by the Caterpillar Company.

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Burch Corporation Adds Snow Plow to Line

Arrangements were recently completed whereby The Burch Corporation of Crestline, Ohio, who manufacture a line of road building equipment, took over the manufacture and sale of the Ross Snow Plow, formerly made at Batavia, New York.

According to report Mr. Lester T. Ross, the original designer of this mould-board type plow, will be associated with The Burch company in the capacity of chief engineer of the snow plow division. The new arrangement is expected to greatly increase the use of the plow through enabling Mr. Ross to secure the increased manufacturing and engineering facilities of the Burch Corporation.

Tinius Olsen Company Plans \$75,000 Improvement

The Tinius Olsen Testing Machine Company has awarded a contract for the erection of a six-story addition for storage and assembling purposes, as well as for an enlarged erecting floor with increased crane way for the erection of large testing and balancing machine equipment. It is said the new addition completely equipped will represent an expenditure of approximately \$75,000.

Pendock Made Director of Independent Pneumatic

Charles W. Pendock, president of the LeRoi Company, Milwaukee, Wis., has been elected a director of the Independent Pneumatic Tool Company of Chicago, according to recent announcement.

The LeRoi Company manufactures the gasoline engines which are used in the Independent Company's portable air compressors.

Mr. Pendock succeeds the late William A. Libkeman, who was a director of the company for many years.

Some Personnel Notes from Independent Pneumatic Tool Company

W. A. Nugent, manager of the St. Louis office of the Independent Pneumatic Tool Company has been transferred to Chicago where he will serve as manager of the Chicago territory, according to recent announcement.

F. J. Passino, manager of the Pittsburgh office has been sent to St. Louis, where he will be located as manager of that territory.

T. J. Clancy has been sent from the Cleveland office to Pittsburgh to manage the Pittsburgh territory.

Personnel Items from Universal Atlas Cement Company

The Universal Atlas Cement Company announces through its treasurer, T. E. O'Connor, the transfer of E. M. Johnson, assistant treasurer, from Pittsburgh to Chicago, and the appointment of A. B. Wells, assistant eastern credit manager at Pittsburgh for twelve years, as assistant treasurer at that office.

Mr. Johnson has been connected with this organization for twenty-three years,

and has also served the Illinois Steel Company, another steel corporation subsidiary. Mr. Johnson is not unknown in Chicago, for before going to Pittsburgh he was assistant credit manager at the company's main office, having previous to that time taken special advanced accounting work at Northwestern University. In returning to Chicago he is to fill the position formerly held by A. J. Joyce, resigned.

Mr. Wells has spent twenty-nine years in the employ of the United States Steel corporation, twenty-one of which were in the Pittsburgh office of the Universal Atlas company.

G. H. Williams Appoints Indiana Distributors

To give complete and prompt service on clamshell and dragline buckets and heavy-duty trailers in the Indiana territory, the G. H. Williams Company, builder of the Williams Champion series of buckets for all classes of excavating and rehandling, and the Williams Arch-Girder heavy-duty trailer, has appointed A. F. Deaney, Indianapolis, Ind., distributor for Southern Indiana, and the Stockberger Equipment Company, Fort Wayne, Ind., as distributor for Northern Indiana.

New Distributors for Chain Belt Co.

Chain Belt Company of Milwaukee announces the appointment of two new distributors in the Construction Equipment field, namely: the Alabama Machinery & Supply Company of Montgomery, Ala., and the Concrete Products Sales Company, Ltd., of Oakland, Cal.

New Eastern Representative for Universal Power Shovel

Mr. C. D. Buoy, sales manager for the Universal Power Shovel Company, a division of the Unit Corporation of America, Milwaukee, Wis., announces that the Tractor and Equipment Company, located at 520 Passaic Avenue, Newark, N. J., will handle the Universal products in the eastern territory which they serve.

Four Wheel Drive Pays Dividend

According to recent announcement, the twelfth consecutive cash payment has been made by the Four Wheel Auto Company of Clintonville, Wisconsin, to cover the regular semi-annual three per cent cash dividend to stockholders of record October 1st. The total amount of payment was \$51,828.

The Patents Holding Corporation of Frederick, Md., has granted a license to the Caterpillar Tractor Company, Minneapolis, Minn., to manufacture power propelled road graders and maintainers under patents controlled by their corporation, according to recent announcement.

Cletrac Keeps Up With the Times

One of the most colorful of commercial calendars for the year 1931 has just been put out by the Cleveland Tractor Company. The illustration which looks like an artist's drawing is said to have been taken from an actual photograph of a Cletrac pulling the mooring mast used for the anchoring and hauling the dirigible in and out of the hangar. Want one? Write the company.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912

Of Roads and Streets published monthly at Chicago, Illinois, for October 1, 1930.
State of Illinois [ss.
County of Cook]

Before me, a Notary Public in and for the State and county aforesaid, personally appeared E. S. Gillette, who, having been duly sworn according to law, deposes and says that he is the business manager of the Roads and Streets and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Gillette Publishing Company, 221 East 20th St., Chicago, Ill.; Editor, H. P. Gillette, 221 East 20th St., Chicago, Ill.; Managing Editor, C. T. Murray, 221 East 20th St., Chicago, Ill.; Business Managers, E. S. Gillette, 221 East 20th St., Chicago, Ill.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.)

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3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholders or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is (This information is required from daily publications only.)

E. S. GILLETTE,
(Signature of business manager.)

Sworn to and subscribed before me this 26th day of Sept. 1930.

KITTEE C. WOULFE,
Notary Public.

(Seal.)

(My commission expires Feb. 8, 1934.)

ROADS AND STREETS

Design, Construction, Maintenance and Traffic Control

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Vol. LXX, No. 12



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December, 1930

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Addresses will be changed as frequently as desired, upon notification; not otherwise. Changes of address should be sent in at least two weeks before the date of the next issue in order for them to be effective for that number. Immediate notice should be given of any delay in the receipt of the magazine.

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In addition to the advertising messages to be found in this issue of Roads and Streets on the pages as indicated above, condensed catalogs of those marked * as well as other specifications and construction data will be found in the Road and Street Catalog and Data Book, the 384 page annual reference guide for the highway industries, published by the Gillette Publishing Co.



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